AGRICULTURAL ENGINEERING

The Journal of Engineering as Applied to Agriculture

RAYMOND OLNEY, Editor

Vol. 6 MAY, 1925 No. 5

EDITORIALS

Recognition

IT would be hard to find more convincing proof of the educational importance of agricultural engineering than the growing interest shown in its development by the Society for the Promotion of Engineering Education. The attitude of these engineering grandfathers toward agricultural engineering has passed through successive stages of open hostility and concealed skepticism to good-natured tolerance, and finally to that kind of interest which presages enthusiastic support. An appeal has recently come from them to the president of the American Society of Agricultural Engineers for more information to supplement the fragmentary data furnished by the writer, and a committee to supply this need is now being organized.

No profession that is represented in more than thirty of our leading educational institutions and that serves annually 13,000 students can be lightly brushed aside by any thinking person. At the seven colleges offering degree courses 238 undergraduate and 18 graduate students were enrolled (December, 1924) and the degree of B. S. in A. E. had been granted to a total of 277 professional students.

Recognition, of course, while gratifying, brings with it a commensurate degree of responsibility that we all share alike. The heights of esteem to which agricultural engineering may eventually rise depends entirely upon the personality, professional pride and ethical standards of its individual members. Shall we accept the challenge?

Q. C. AYRES

"The Sliding of Metal Over Soil"

THROUGH an error an explantory note accompanying the article, entitled "The Sliding of Metal Over Soil", by M. L. Nichols, appearing in the research section of AGRICULTURAL ENGINEERING on page 80 of the April 1925 issue, was not included with the article.

This particular article was a contribution from the Research Committee of the American Society of Agricultural Engineers, of which Prof. Nichols is one of the active members, and is a progress report of studies under way at the Alabama Agricultural Experiment Station. As a preliminary report it analyzes methods to be followed in the continuation of the work, and in addition the data so far obtained are indicative of how the major problems can be solved.

This work is one of the most fundamental and important pieces of agricultural engineering research, with a truly practical objective, which has ever been reported. The tentative results so far obtained are of wide importance in the design of tillage and traction machinery. The author brings out their significance in plow design and indicates strikingly that the present theories of plow design are in some cases either of limited applicability or are not applicable at all. A striking indication of the fundamental nature of this work is the fact that it already explains some of the empirical findings of Davidson, Collins, Fletcher, and others in their plow draft tests. It is an excellent example of what should comprise fundamental research in agricultural engineering, and it is to be noted that not a single case of comparative testing of things we already know is included. On the other hand, this work is a precise, systematic manipulation of fundamental science in an obvious attempt to solve a very practical class of problems.

The analysis of the subject of soil colloids and tillage, presented by R. W. Trullinger in the March issue and concluded in the April issue of AGRICULTURAL ENGINEERING, attempts to provide a background for the study of tillage and tillage machines by pointing out the fundamental nature of some of the conditions imposed by the colloidal and other physical properties of soils, which must be met in the production of desired tillage results. Prof. Nichols' article follows up this analysis in a most significant and logical manner by indicating, as a result of actual experiment, some of the fundamental lines along which tillage tools can and should be developed to specifically meet these soil conditions.

Steps forward such as are indicated by this paper are very timely and should be of immediate practical value to the implement industry. The Research Committee is urging Prof. Nichols to continue his study not only on account of its far-reaching practical importance, but owing to the fact that it is a striking criterion of what agricultural engineering research ought to be.

Encourage This Thing

THE American agricultural trade commissioner at Berlin reports that consulting agricultural engineers are being employed in Germany by groups or "rings" of farmers. Each ring employs an engineer whose services belong to the members. If the ring is made up of large farmers, three or four farmers may have enough work to keep an engineer busy; if the ring happens to be made up of small farmers living together in a village, he may work for as many as a hundred. His job is to advise the farmers regarding the equipment needed.

Right along this line is the new type of cooperation that has been entered into recently by two hundred and forty farmers in four Illinois counties. These farmers have banded together in order that they may employ a trained man to assist them in keeping farm accounts and putting their farm operations on a more efficient and profitable basis. Most of the cost connected with the service will be met by the two hundred and forty farmers themselves. The total cost will be about $25.00 per member a year, and each of the two hundred and forty members has signed up for three years.

In commenting on this plan the "Rural New Yorker" believes that ultimately some such plan will take the place of the present farm bureau system. Of particular significance to agricultural engineers is the flat statement by that publication that "farmers would be better off in the end if they would pay their own money for what they need in this trained farm service."

This idea is one which should receive every possible encouragement from the agricultural-engineering profession because herein lies one of the important means of putting agricultural development and prosperity on a level with that in other industries and businesses. There is no reason why a farmer should not pay for engineering service any more than a manufacturer or other business enterprise. Naturally, it would greatly extend the field for agricultural engineers and also be a factor of tremendous importance in the more rapid development of agricultural engineering. Agricultural engineers should miss no opportunity to encourage this thing.

The Combined Harvester-Thresher *

By W. F. MacGregor

Mem. A. S. A. E. Chief Engineer, J. I. Case Threshing Machine Company

THE idea of combining the operations of cutting and threshing grain so that both are done at the same time by one machine is not new. On the contrary, it seems to have occurred to at least one individual nearly one hundred years ago. The U. S. patent office shows a patent on a combined harvester and thresher as early as August 8, 1828. Briggs and Carpenter patented another February 6, 1836, claiming the principle of the ground drive. Moore and Hascall of Kalamazoo, Michigan, patented a machine on June 28, 1836, which seems to have had many of the elements of success. Probably had the inventors lived on the Pacific coast where crops and weather are more favorable, it would have been made a complete success. But they were attempting to introduce, not only a new machine, but a new harvesting method in a territory where it was thought that the grain must be stacked and go through the "sweat" before being fit to thresh. It was quite an undertaking in itself to introduce the idea of threshing immediately after cutting at a time before even shock threshing had become popular. We find other patents on harvester-threshers on March 16 and May 14, 1841, and June 25, 1845. R. L. Ardrey, in his book "American Agricultural Implements" published in 1894, says, "The invention of the main features of this machine was recorded in the patent office before any hand-raking reaper had been made practical for the market, and it seemed at first as though it would come into general use."

Up to this time the men whose vision was sufficiently clear to enable them to see beyond their own generation had all lived in America, but in 1845 a man named Ridley in far-off Australia appears to have grasped the same general idea. His machine attracted considerable attention at the time, and the English papers were not particularly pleased to be told that machines embodying the same principles had not only been patented, but had been built and used in the United States prior to this time. Ridley's machine did not cut off the heads with some straw by a reciprocating sickle cutting against the non-reciprocating guards in the manner of all American grain harvesting machinery so familiar to us. Instead of a cutting sickle, this Australian harvester had a comb which, upon coming into contact with the standing grain, allowed the straw to slip through until the head was caught and stripped off. This stripper principle is very old; in fact, it forms the important part of the oldest grain harvester of which we have any record. It is found on the machine made and used by the Gauls in the first century.

Some years after Ridley's time the stripper type harvester-threshers became very popular in Australia. The comb was improved by mounting a "rippling" cylinder above it to aid in loosening the kernels from the head and to help to prevent choking. In the operation of this machine the cob of the head and some of the chaff is left on the straw, so that in order to produce clean grain it is only necessary to blow out the light chaff. This method thus greatly simplified the subsequent operations, as no separating from the straw was necessary and there was no straw to handle. The Australian machine, of which the "Sunshine" is the best known example, is comparatively simple. It is ground driven and has been made in the smaller sizes: 5, 6, 8 and 10-foot cut. It carries a grain box holding a few bushels. When this is full the machine is stopped while the grain is run into sacks. The Australian stripper has been of enormous benefit to the farmers of that country where conditions are favorable for its use. During the last forty years thousands of them have been sold there. When tried in other countries, however, it has not been very successful. When tried in the Argentine and in California where much of the ground was looser, the grain was either pulled up by the roots or two much grain was left in the heads.

But while this machine was being developed in Australia from Ridley's time on, inventors in our own country were making progress with the sickle type of harvester-thresher. In the '60's several patents were granted to men in the middle west and a few to residents of California and Oregon. The first California "combine" appears to have been built by D. C. Matteson, at Stockton in 1867. In the '70's several men on the Pacific coast seem to have realized the possibilities, and these ideas crystallized into actual machines, so that in the '80's the combine had been proven practical in the field. In 1887 there were several of them scattered through central and northern California. About 1890 at least three companies — Houser & Haines, Best and Holt—were in a position to make as many machines as the market might require. Six or seven years later they had become common in California and their use had spread to Washington, Oregon and Idaho. These machines were equipped with bagging platforms, the grain being run into sacks which were sewed up as the outfit moved along. The sacks were then dumped off in groups of three or four and afterwards gathered up.

These early machines were all large, cutting a swath of from 16 to 30 feet wide or even wider, weighing from ten to fifteen tons and requiring from 18 to 40 horses or mules to pull them. An idea of the size of these machines and how it sometimes impressed the purchaser may be had from the following incident: In 1892 a salesman had obtained an order from a farmer on the Snake River in Washington. The harvester was shipped by steamboat and when it arrived the farmer refused to accept it, saying he did not expect to get a whole lumber yard. The manufacturers were obliged to unload and operate it the first season. Thirty-six horses were required to pull it on the farmer's land, instead of twenty, as he had been told, but he paid for it and used it successfully many years thereafter. Thus were the machines introduced into new territories.

One of the serious obstacles encountered when the combined harvester-thresher was first introduced in the state of Washington was the difficulty of satisfactorily accomplishing the cleaning and separating while the machine traveled over the steep hills and was tilted to somewhat severe angles as it went along. But the situation was met by the introduction of the leveling device which is now used on all machines operating in the hills. These "hills", as the natives call them, are more like mountains, and some of them are so steep that a bag of wheat dropped off from the machine will roll down hill. The rain often washes deep gullies in the hill sides so that the machines encounter rough going and are subjected to severe strains. All of the side-hill machines were pulled by horses and nearly all still are, for many of the hills are too steep for tractors. However, as some of the early builders of combines also built steam traction engines, it is only natural that in the more level places these large machines should be sold for steam power, and this was done as early as the early '90's. A few years later an auxiliary steam engine was mounted on the combine, receiving its steam from the boiler of the tractor. This was the first deviation from the ground drive which had been used on all former types.

About 1912 the first internal-combustion-motor-driven harvesters made their appearance in Washington. On the ground driven machine the speed of the thresher depends on the rate of travel, and this is quite objectionable as a constant speed is more essential to the successful operation of a thresher than it is to other harvesting machinery. Then

*Paper presented at the meeting of the Farm Power and Machinery Division of the American Society of Agricultural Engineers, Chicago, December 3, 1924.

too, in case the machine is choked it is a serious matter as there is a long passageway through the machine that may require cleaning out. Moreover, the machine must be driven out into the stubble in order to run it and avoid feeding more grain into it. These first motors were so heavy as to offset the reduction in draft due to wheel traction and resulted in requiring about as many horses as before. Nevertheless, the fact that the thresher ran continually, regardless of whether the machine was traveling or standing still, and at a speed not dependent on the rate of travel, improved the work of the thresher and constituted a real step in advance in the art.

The self-propelled combined harvester-thresher appeared about twelve years ago, and for about five years seemed to gain considerable popularity. However, the large engine and the expensive transmission parts added so much to the expense that the machine was too costly for the popular demand. It is not logical from an economical standpoint to duplicate the propelling apparatus on machines used only a few weeks each year, when the majority of the buyers already have tractors capable of pulling them.

We have now commented upon the development of the Australian harvester-thresher, which in its typical form is a light, horse-drawn, ground-driven machine of the stripper type with about an 8-foot cut. We have also commented upon the California type of machine, which in its typical form is a heavy horse or power-drawn, motor-driven machine with complete cutting, threshing and separating mechanism, cutting a swath of about 24 feet. Thus in two widely separated localities two radically different machines have developed during the last fifty years. Both are well suited for the conditions prevailing in the places where they were produced. For some time it was popularly supposed that it was possible to use combines only in the comparatively restricted localities of this country such as California, Washington and Oregon, where the harvest season is quite sure to be dry and the straw is so stiff that it stands up and carries the heads for weeks after it has ripened without shattering. Many writers on the subject have expressed this opinion.

But a machine that makes such a great saving in labor and expense cannot be kept in the background by an erroneous popular belief. Those who studied the situation could see possibilties. Over twenty years ago one of our large western implement concerns began the development of a medium sized machine which would meet general conditions better than the large California type. Since that time many experimenters have built and tried out machines in various parts of the country. Many have worked on the idea of threshing from the shock or windrow, and although such a process does not properly fall within the scope of this paper, it is mentioned to show the tendency toward a cheaper method of handling and threshing grain.

Every year since the first California combine was put to work in about 1867 the territory in which this machine is used has widened. About 1917 it received a great impetus, partly because of scarcity and high cost of labor during the war. Its use spread rapidly after being introduced in Western Kansas through that entire semi-arid belt including the Panhandle of Texas, Western Oklahoma, Eastern Colorado and Western Nebraska. The report of the Kansas State Board of Agriculture shows 2796 machines in use in that state in 1923. But they are also being used to a lesser extent in many other states. American machines have been sent in large numbers to the Argentine and some to Australia and other foreign countries. It seems that the Argentine farmers have been very quick to grasp the advantages of this method of harvesting and have outdistanced our own farmers in the rapidity with which they have accepted the new machine. The spreading of the combine area has been so rapid that our old idea of its sale confined to certain limited territory has required revision; so that we are now wondering where the limits—if indeed there are any—may be.

The present demand seems to be for a light weight, medium-sized machine cutting a swath from 12 feet to a rod wide. It should be engine-driven and adapted to be pulled by tractor or horses. It is highly important that it be thoroughly reliable, with ample capacity to function properly under the most adverse conditions. It should be capable of handling not only wheat, but rye, oats, barley, speltz, alfalfa, the kafir corn family, soy beans, and several other crops as well. No agricultural machine is operated under as high mental tension as is the combine. If the user happens to live in the hail belt, a delay in operating of a few hours will mean a great loss should a storm come. The combine cannot start cutting as soon as a binder, and not quite as soon as a header, but when the wheat is ready for "combining", the grower is properly anxious to have the crop cut and the grain in the elevator in the least possible time. Delay may mean that the wheat will lodge, making the cutting more difficult and resulting in some loss; it may mean that the weeds will develop so rapidly as to render more difficult the cleaning and separating operations and increase the likelihood of the grain heating from the pieces of green weeds which cannot be taken out; it may mean that the grasshoppers will eat many of the straws off, allowing the heads to fall on the ground where they are lost.

This picture shows the prairie type of combined harvester-thresher cutting a full 12-foot swath

Thus, when the crop is ready the combine must cut and keep cutting until the crop is all secured and out of danger.

Let us compare for a moment the use of the combine with other methods of harvesting. Most of the grain crops of this country are and have for many years been cut with binders. This means that the grain must be handled at least three times—that is, shocked, then pitched onto a wagon and pitched off onto the stack or into the threshing machine. Each handling means lifting the entire amount of straw and grain by human muscle, and the number of handlings varies from a minimum of three up to about seven in some cases of stacked grain. In binding, the cost of the twine is also a considerable item. On the contrary, the combine puts the grain into the wagon or motor truck without the necessity of lifting by hand even an ounce of either straw or grain. I know of a case where a farmer, with the aid of his wife driving a motor truck and his 13-year-old son driving the tractor, put his entire crop of 450 acres of wheat into the elevator in a nearby village in less than two weeks time. Compare this with the crew of men and horses and machinery necessary to harvest 450 acres of wheat by any other method you may choose; that is, head and thresh from the barges; bind and shock and thresh from the shock; head and stack or bind and stack and then thresh. In short, there is about as much labor required in cooking for the crew needed in any other method as there is in doing the entire job with the combine.

To sum up the advantages of the "combine" method of harvesting, we may enumerate them as follows:

1. It lessens the expense of harvesting and threshing. It is sufficiently accurate for the purposes of this paper to say that the running expenses of the combine amount to about one dollar per acre as against four dollars per acre by other methods.

2. It greatly reduces the number of men and horses required. Other methods in the wheat belt require armies of men from outside and more horses than are required for other farming operations. The combine requires little or no extra men or horses.

3. It simplifies financing the harvest, as it is unnecessary to borrow money to pay for men and teams. When the crop is ripe it may be sold as fast as cut, thus moving the crop faster than by other methods.

4. It saves the fertility of the soil by returning the straw, evenly spread, to the land. It avoids the waste of ground by straw piles, which continue to increase in number year by year where the ordinary threshing machine is used.

5. It entirely disposes of the crop and clears the land at once so that it is immediately ready for the preparation and planting of the succeeding crop in good time for fall rains. I recall a case where a tractor that had pulled a combine, finishing the cutting in the forenoon, was put to work in the afternoon of that same day, disking and seeding the new crop.

6. It handles light crops at a minimum expense, netting a profit on yields that would not pay for harvesting by other methods. It allows wheat to be grown on land too poor or too dry to be otherwise profitable.

7. The combine makes the grain grower independent of outside help and enables him to handle larger acreage than he otherwise could.

Having duly considered the advantages, it is now proper to consider the objections. The usual ones urged are: (1) excessive waste; (2) wheat too damp to keep; (3) spreading weed seeds back onto the land, and (4) straw not available for stock.

With respect to waste, my investigations lead me to believe that waste in the thresher of a modern combine properly operated will not ordinarily exceed what has been termed the "unavoidable waste" of one-half of one per cent. On the other hand it avoids the great waste of other methods. The binder wastes some grain each time a bundle is tied and some is wasted each time—from three to seven—that bundle is handled thereafter. The header method also wastes in various ways. When the grain is shocked there is waste around each shock, and when stacked there is more waste, especially at the tops and bottoms. In one case where a careful test was made to compare the heading and combine methods on a half section, the quarter cut with the combine showed a yield of three bushels per acre more than the quarter which was cut with the header and stacker. I feel that the item "waste" should appear in the list of advantages of the combine and not in the list of objections.

The second objection—damp wheat—is a somewhat more real one, but perhaps not unsurmountable. It has been claimed that the combine could not function in a rainy harvest, but there is now evidence to the contrary. In 1923 in some sections of the Southwest the rains started in about two weeks before the time for the usual beginning of the harvest and continued for several weeks. This so delayed the harvest, regardless of the method, that before much of the grain was cut the weeds had grown to a volume rivaling and sometimes greatly exceeding the volume of the wheat straw. Under such conditions stacking was out of the question, and bundle grain even rotted in the shock. Here the combine showed that it was equal to the occasion, for it went into fields that appeared to be all weeds and got the wheat. Of course, the wheat contained pieces of green weeds to an extent that would not let it be stored in bulk, but it certainly was easier to keep the comparatively small bulk of threshed wheat from spoiling than to try and preserve the entire crop of wheat straw and green weeds.

I feel that there is no damp wheat problem so far as the combine's ability to get the wheat out of the heads is concerned. The damp wheat problem begins where the combine leaves off. We know grain will keep in sacks, or spread on the ground, or if continually moved, when it will not keep in bulk in the granary or elevator.

Many of you are familiar with the experiments made at Ripon, Wisconsin, in drying stacks of grain by passing air currents through them. It seems reasonable that very damp grain can be kept from spoiling by elevating it and allowing it to fall through a blast of air repeating the process as many times as may be necessary. It is at least conceivable that some means will be devised for drying wheat in granary and elevator. When this is done one of the largest obstacles in the way of the general adoption of the combine will have been overcome.

It has been stated that in some sections the grain does not ripen evenly enough to allow the use of the combine. This situation has been met to some extent in California by selecting varieties which will stand for some time after ripening without shattering, so that the green patches can ripen and all be in condition to "combine" at one time. We have seen many examples of the development of varieties or strains of grain to meet certain conditions. It is not quite possible to develop non-shattering varieties with straw stiff enough to carry it until the entire field is ripe. When this is done and the damp grain problem is solved, the combine's field at once is extended to include nearly all of the grain growing territory.

The third objection mentioned was the spreading of weed seeds. Although there is much to be said on both sides of this question it will be only briefly mentioned here. The bulk of the weed seeds are either too green to grow at the time the combine cuts them, or so ripe that they are already shattered, and the fact that the field is cleared at once allows disking to destroy those left in the stubble. The land on which combines have been used for several years does not appear to be more foul with weeds than land harvested by other means.

The fourth objection, the straw from the combine not being available for stock, is not present in the territory growing grain exclusively, but becomes of great importance in the mixed farming districts. It can be partly met by equipping the combine with a straw dump and gathering up the straw afterwards.

In conclusion, I feel that (1) the use of the combine is not likely to become general in the immediate future, but it is quite certain to continue spreading to new fields; (2) that the engineers have the situation fairly well in hand so far as meeting present requirements are concerned and that as new requirements arise they will be met by the production of suitable machines, and (3) that at present more can be accomplished to aid this desirable method of harvesting by devising means of caring for damp grain and by developing varieties of grain suitable for its use.

In any event, we may rest assured that a machine which

saves as much labor and expense as the combine does, will continue to be used in larger and ever larger numbers, regardless of a favorable or unfavorable attitude on our part.

Discussion

Mr. Aspenwall: The Society is greatly indebted to Mr. MacGregor for the paper he has presented, because I know that it took a lot of work to prepare a paper of that kind. It is probably the first paper that has gone into details on the history of the development of the harvester-thresher, and it should be preserved by those interested in this line of machinery.

The cost of harvesting with the combine, considering present prices for labor and expense of all kinds, is about 5 cents a bushel, where the crop is average, as against 15 to 18 cents a bushel for the thresherman's charge alone for the regular thresher, to say nothing about the other work of cutting, handling, hauling, etc., and in the saving of grain you can figure about 10 per cent. If the crop is a 30-bushel crop it will save 3 bushels per acre over the old method of harvesting—about 10 per cent more of the crop will reach the sack through the harvester-thresher than it will in the case of the old method of harvesting and regular threshing. That has been proven time and time again, so that a combine should pay for itself in a short time. It will pay for itself in one year, if you cut enough acres; with the ordinary-sized farm it will pay for itself in a very short time in the saving of the grain and expense in harvesting.

The use of the machine is spreading all the time. It started, of course, in California. They start the machine about the tenth of May in Southern California, and it is in continual use until about October, in the extreme Northwest. It is used extensively in Northern Texas (the Pan-Handle), Kansas and Colorado. It has now worked its way into western Nebraska, and in time I am quite sure it will find its way into western South and North Dakota, as well as all the territory west from there, or wherever it is a semi-arid district. Whenever the grain really matures or nearly matures on the stalk it will eventually be used.

It is bound to come east too. Farmers are buying them who don't plan on using them every year. They use the harvester-thresher in the dry years, and in wet years they will use their binders or headers. We have a farmer in southwestern Missouri who uses one of those machines. He has a farm located on high ground; he bought the machine four years ago and has used it every year since. Those farmers who have land where the grain matures on the stalk, where the soil conditions are such that it maintains a good stand and ripens on the stalk, and they who are willing to wait and run the risk of storms, can harvest with the harvester-thresher seven years out of ten.

The "Combine" in the Corn Belt States

By J. C. Wooley

Mem. A. S. A. E. Professor of Agricultural Engineering, University of Missouri

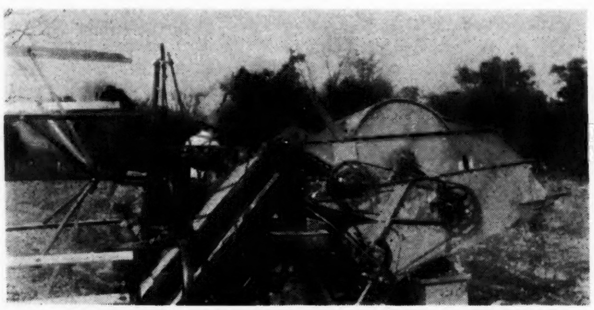
THE experiment stations that are devoting some attention to the problem of curing crops in storage may furnish information which will give us more light on the possibilities of the combine in the Middle West. If we can cure grain in the bin by means of forced ventilation, it would certainly be a safer method than the present practice. However, there are a greater number of factors to be considered than this one.

We must have new varieties which will ripen evenly and which will not straw break or shatter, in order that threshing may be accomplished with any degree of satisfaction. I have discussed this phase of the question with several men who are interested in plant breeding, and they give me very little encouragement. We think of the Club wheats which have been developed in the Pacific Northwest as examples of what has been done along this line, but the plant breeder always cites the differences in weather conditions, both during the growing and harvesting seasons, which makes the task seem impossible. The agricultural engineers can take care of their part of the problem. They can overcome a thing like the weather in the harvesting operation; the machinery developed for handling the rice crop is ample evidence of this. If the plant breeder can develop a crop which will stand up and ripen sufficiently for threshing, the engineer will be ready with the machinery to harvest it.

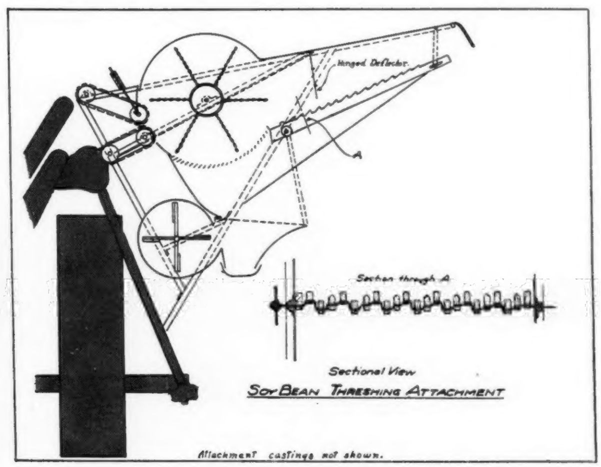
I have been asked to talk on the adaptability of the soy bean crop for use of the combined harvester-thresher and also to discuss the soy bean threshing attachment which I have had a part in developing.

As near as I can find out, there are about one hundred and forty varieties of soy beans. These varieties differ in size, shape, quality, and color of seed, in the size, manner of growth of stalk, and also in the ease with which the seed may be separated from the pods. With this wide variety of characteristics, it is manifestly impossible to design a machine to meet them all, but to meet the needs of the bean growing sections of our country, we need only work with a few of the varieties which are classified by the plant breeder as the non-shattering varieties. These varieties are, of course, the only ones which can be handled with the combine successfully. I believe I am safe in saying that 95 per cent of the beans raised for seed in Missouri are of the non-shattering variety. At the Missouri station this year, a field of Virginias was divided. One part was cut with the binder when the pods were dry, although the leaves on most plants were partly green. These bundles were shocked and handled in the ordinary way. The remainder of the field stood, some of it for seventeen days, before it was harvested with a grain binder and the attachment I have mentioned. In this time, the leaves had all fallen from the stalks, but no shattering or popping could be detected by those who inspected the field. It must be admitted, however, that the conditions this fall were ideal in this field. It was well drained and there was practically no growth of weeds or grass.

After the beans were threshed, they were placed in bins 4 feet square and 6 feet deep. These bins were provided



A rear view of the soy bean threshing attachment for binder



A sectional view of the soy bean threshing attachment

with a means of securing forced ventilation in case they showed any tendency to heat. Moisture tests showed that they contained only 11 per cent as they came from the field, consequently there was no rise in temperature and the ventilation system was not needed.

The soy bean threshing attachment for a binder, which we have been developing at Missouri, was designed to meet the needs of the farmer for a threshing mechanism, which would harvest the beans in the field and which would not require any great outlay of money in first cost. Most farmers have the grain binder, and by providing them with a replacement head for threshing beans, they would be able to get greater use from their binders.

As stated before, the non-shattering varieties of beans furnish a crop which is well adapted to the use of a combine, and by harvesting the beans in this way, the cost can be very materially reduced. The loss from shattering during the binding, shocking and hauling process can be eliminated, as well as the loss from rotting in the shock. The threshing of the soy bean is somewhat different from the threshing of wheat or oats. The only power needed is an amount sufficient to break open the pods and then to separate the beans from the loose pods and dirt. Any work that is done in tearing up the straw is wasted energy as far as the threshing operation is concerned. By use of the flexible chains on the cylinder of the threshing attachment, instead of solid teeth, the plants are flailed sufficiently to break the pods but very little energy is wasted in shredding the straw.

The process of cleaning is very much simplified when this process of threshing is used, since there is less chaff and broken straw to deal with.

It is desirable, of course, to have the straw fed into the cylinder as near at right angles to its length as possible. With no change in the binder at all it was found that the straw would reach the top of the elevator canvasses at about 45 per cent with respect to the cylinder and rollers. A retarding device consisting of an extension of one of the guards over the sickle served further to retard the butts as they fell on the platform canvas and to bring the straw into the cylinder in a very satisfactory manner. The straw as it leaves the elevator canvasses is held between the upper and lower field conveyors, the outer end of the upper conveyor being free to move to take care of varying thicknesses of grain that might enter. The compression spring shown in the accompanying sectional view serves to maintain a pressure between the feed conveyors and to keep the proper tension in the upper conveyor web. The speed of the cylinder was regulated so that the grain moves out 1½ inches from the time one chain strikes it until the second one reaches it, so that the straw is thoroughly flailed before it is released by the feed rollers. Quite a few pods are broken open by the pressure between the feed rollers, but the principal part of the threshing is accomplished by the cylinder and the grate beneath it. The grate is made up of flat bars sloped so that the straw will be carried over but spaced sufficiently far apart so that the threshed beans can filter through. The straw is thrown against the flexible curtain and then falls on to the straw rack. The sectional view of the straw rack shows the method of construction. The fixed slats prevent the straw from following the movable slat as it goes to the lowest position. This prevents any tendency to drag back, and when the movable slats strike the straw from below, it produces sufficient agitation to secure complete separation of threshed beans and straw. The threshed beans, pods, etc., are collected by the two sloping pans and delivered on to the screen. The fan produces a blast up through the screen which is sufficient to carry off pods, chaff, etc., but which will allow the beans to fall through into the collecting trough below.

No means has been provided on this experimental model for sacking the beans, but this item should not furnish much difficulty.

Power is taken off through the elevator chain by substituting a sprocket in the same position as the sprocket which drives the packer shaft on the regular binder head. One pair of spur gears on this jack shaft and the fan shaft gives the speed desired for the fan and gives the reverse direction for the fan and cylinder shafts.

The straw rack and lower feed conveyor are driven directly from the jack shaft.

The attachment seems to require about the same amount of power as is required by the binder head during the process of tying the bundle.

The binder head can be removed by two men in from 30 to 45 minutes, and the attachment installed in a similar length of time. No changes are required in the binder save the removal of the parts mentioned.

We believe that the machine can be used successfully with several other crops in addition to the soy bean. Sweet clover, timothy, orchard grass, and buckwheat are crops which are easily threshed and which might be handled by the attachment.

Airplane Dusting of Cotton

THE studies being made on boll-weevil control by means of airplane dusting have been continued more extensively during the past year than ever before. A great deal of attention has been given to the mechanical features of the problem, and numerous devices for distributing the poison from the plane have been developed and perfected. Different types of planes require quite different equipment. Special planes are also being developed for this work and extensive plans are under way for more widespread use of this method in the future.

The airplane dusting has led to many interesting and important developments. There has been an indication, for example of the possibility of dusting by daylight. Heretofore the poison has been applied at night when moisture on the plant caused the dust to adhere. It has been found that by charging the dust with electricity of a polarity opposite to that of the plant, the dust, as it settles over the field, is attracted and adheres to the plant, covering its leaf and stem surfaces completely.

The Bureau of Entomology of the U. S. Department of Agriculture is making an extensive study of airplane dusting. An extensive project is under way, involving the cooperation of the division of agricultural engineering of the U. S. D. A. Bureau of Public Roads on the mechanical side and the Bureau of Standards of the Department of Commerce on the electrical side, thoroughly to work out the principles involved and their possible application to commercial operation.

A thorough study has been made of the different types of calcium arsenate in relation to their effectiveness for weevil control. This is being correlated with methods of manufacture and several new methods have been studied. It is hoped that when this study is complete a much more efficient calcium arsenate will be available, and furthermore that it will be possible to eliminate materials of low efficiency which have been responsible for erratic results obtained by the farmers in the past.

Increased Interest in Agricultural Engineering

SOME interesting statistics on the attendance during Farmers' Week at Ohio State University in February have been furnished by Prof. G. W. McCuen, head of the department of agricultural engineering. There was a total registration of 5,400 attending the Farmers' Week. Of this 48.2 per cent (by actual count) attended lectures and demonstrations given by the department of agricultural engineering. It is one of the highest attendances ever recorded in any department on the campus.

During the month of February the attendance at extension lectures in agricultural engineering was 5411. The nearest competitor was the farm management department, at which the attendance was 4435. The activities of the agricultural engineering department at Ohio State University have greatly stimulated interest in farm equipment throughout the state, which is proven by the large attendance of farmers at extension programs.

Research in Agricultural Engineering

Research activities in the agricultural-engineering field are presented under this heading by the A. S. A. E. Research Committee. Members of the Society are invited to discuss material presented, to offer suggestions for timely topics, and to prepare special articles on any phase of agricultural engineering research

The Publication of Research *

By E. W. Allen

Chief, Office of Experiment Stations, United States Department of Agriculture

THE ultimate aim of research is publication. It may be deferred, but it is due eventually if the research has been successful. To some this final task, like the end of a poor cigar, is often very bitter. But in research the end is even more important than the beginning, and quite as deserving of being well done as any other part of the work.

The idea that in writing a paper "anything will do", and that it is a weakness and a waste of time to be fussy about it, will rarely bring a creditable printed report or stamp the author as a painstaking investigator. Writing is, to some extent, a special aptitude or requirement, and those with whom it is not a native ability can do much to improve it by practice and by taking pains. It is especially important for the scientist, because it is his means of communication and, to a large extent, of his influence. Hence his attitude toward the task should be right.

Publication is a serious matter because of the permanence of the record. A printed paper can not be recalled or retracted as the spoken word can; it stands for all time. Of course, a statement may be explained or modified after it has been published, but it is difficult to reach all readers of the original, and the correction may be overlooked in future citation.

For us in the Department of Agriculture, which stands so close to the public on the one hand, and to various branches of science on the other, the obligation to publish the results of investigation in suitable form is no less heavy than that of making the work itself exact in method and deduction. The manner in which this is done will reflect not only upon the individual worker but upon his organization and the Department as a whole.

Unfortunately, much scientific writing of the present time is loose and indefinite in its expression, verbose often to the point of being tedious, and out of harmony with the ordered, exact and logical nature of science itself. It is the subject of much unfavorable comment not only by the press but by other classes of writers. Sir James Barrie recently remarked that "The man of science appears to be the only man who does not know how to say it." Apropos of certain "diffuse" and "overloaded" papers presented at the British Association a few years ago, the "London Times" pointedly remarked that "Science should not disdain the art of presentation." The publications of the Department and the experiment stations have long been popular subjects for newspaper gibes, sometimes partially merited and frequently a reflection on the reporter for his lack of understanding or for being so far behind the times.

While we can never hope to wholly escape such comment, we can take away such ground for it as lies in faulty writing or failure to adapt the text to the audience addressed. For it is all too true that scientific men are often unsuccessful writers, not only for popular reading but for their fellow specialists. This is partly because their training has not been in that line and their minds have been schooled to analytical habits, and partly because they are not willing to take sufficient pains or exercise critical judgment in selecting and presenting their material.

*A lecture before the class in "The Nature and Method of Research," Graduate School, U. S. Department of Agriculture, February, 11, 1925.

The Purpose of Writing

The purpose of writing is not only to express ideas, but to communicate them to others. Science is not inherently dull, heavy, and hard to comprehend; it is essentially fascinating, understandable, and full of charm. It is simple, after it has been worked out, and is capable of being stated in concise terms easily understood. But to succeed in conveying ideas correctly and in a readable way requires considerable effort on the part of most of us. It calls for time to do it well. It is just as important as making more experiments, although the worker may not like it as well, and it is quite as worthy of his best effort. He should take care not to overestimate his ability to dash off a research paper at odd times.

The aim in publishing research, as well as in carrying it on, is to leave the field clearer than you found it. If that can not be done it is doubtful whether a scientific paper is justified. There can not be clear writing without clear thinking, and when one learns to write clearly, he will in the process learn to think clearly. Indeed it may be doubted whether thought and its expression can be separated. Vagueness or turbidity of language usually indicates similar qualities in the thinking. The attempt to express a matter clearly in writing thus helps in the process of clear thinking. Bacon wrote that "Reading maketh a full man, conference a ready man, and writing an exact man."

Obligation to the Reader

Clearness. Since the object of writing is to communicate information, the writer may well give special attention to being intelligible. The audience addressed needs to be kept in mind and the language adapted to the reader. Sir Clifford Allbutt lays down the good rule to "take pains with yourself first and then with your reader"; and says further; "A writer who writes to convince and not merely to see his name in print must learn to lay his mind alongside that of his reader."

In other words, it is necessary to understand and keep in mind the point of view of those it is desired to reach, the mental background with which the new facts must be harmonized. The writer must know how to present his facts and arguments so that they will fit into the reader's experience and what he already knows. The reader may know something about the subject, but he doesn't know the point of view from which it was taken up, the purpose, and the reasoning, or how the work further clarifies the subject, unless these things are presented in their proper setting.

Clearness is absolutely essential in technical writing. It is not enough to use language that may be understood—it is necessary to use language that can not be misunderstood. Whether we agree with the author or not, we should never be in doubt as to what he means.

One of the first requisites to clearness of expression is

mastery of the language—not in the mere passive sense of avoiding errors, but positively, as a flexible medium for the exact, unmistakable expression of thought. The choice of words, the order in which they are arranged, the sequence of clauses composing sentences, and, finally, the arrangement of sentences in a paragraph are important features in effecting clearness.

Words are the vehicle of language. They are to impart ideas; hence care needs to be exercised in their choice. There are fine shades of meaning to be observed. The use of the right word will save considerable explanation and thus assist brevity. "The wrong word derails the thought; the needless word is an obstruction." The cultivation of a fairly broad vocabulary is desirable, but it is preferable to repeat the same word, if necessary to make the meaning clear, instead of adopting one that does not fit, for the sake of variety.

Lavoisier, writing on the expression of ideas in 1789 said: "Every branch of physical science must consist of three things: the series of facts which are the objects of science, the ideas which represent these facts, and the words by which these ideas are expressed. Like three impressions of the same seal, the word ought to produce the idea, and the idea to be a picture of the fact. . . . . . As long as precise terms are lacking we can only communicate false or imperfect impressions of these ideas to others."

Having something to say, therefore, say it in your own way, provided you use good diction, the right word, and a simple form of expression. Above all, make your meaning clear. Read over each sentence to see if it expresses what you desire to say. Eliminate each word that is not necessary to the sense or the spirit of the article. Words are only useful for expressing ideas; fine writing and high-sounding phrases have no place in technical articles. Choose your words with care. Make each sentence convey an idea, and don't try to put more than one idea in a sentence. Punctuate so as to bring out your meaning; the punctuation is a part of the writing.

On this subject of lucidity in writing, I should like, even at the risk of some repetition, to quote from Dr. Erwin F. Smith of this Department, who has given some remarkably good advice on writing.* ..He says:

"Clarity is the soul of truth, and especially in science there should be an idea behind every expression, and this idea should be stated as clearly as language permits. . . . There are various ways of saying things, but only one best way. Nevertheless, to read the contributions of many scientific men one would suppose they must think any method of expression sufficient, even the most clumsy and ambiguous. Yet such is not the case. In spite of this motley array of bad writers, it is best that subject and predicate should agree, ... and especially that each statement should be susceptible of but one interpretation.

"Every paragraph and sentence in your paper should receive careful and repeated consideration, first, as to whether it tells the exact truth; second, as to whether it is absolutely clear, i. e., will convey the same meaning to all as to yourself; third, as to whether it is complete, or requires various additions or qualifications (science is an eternal qualification); fourth, as to whether the sentences in it are entirely logical and move convincingly toward your final conclusions. These things can be determined only by repeated readings and much pondering. . . . . Occasionally there is a person who can write a thing as it should be the first time trying, but I have known only one or two such persons. Generally, easy writing is hard reading. Darwin sometimes recast his paragraphs a dozen times, and most of us may expect to reach a good style, if at all, only by dint of much labor and repeated rewriting. Yet who can doubt that it is an end worth all it may cost?"

So remember the reader. Be sympathetic toward him. He must make some effort, but he is not bound to follow you through. The writer has not the same hold on his audience that the speaker has. You may have to see it through if you get into a dull or unprofitable lecture, but the reader does not have to stay by an article that is hard to follow, badly put together, or tedious in its extravagant length. The author must interest and hold the reader if he expects to accomplish his purpose in publication. If a paper is direct and understandable, and has something worth while to say, it will be readable and interesting—often entertaining. If it is not interesting it will not be read, or only skimmed as a matter of duty. It is not always the fault of the public or of brother scientists if they are not familiar with your published work; a part of the burden rests on you.

Study to communicate the results of research in a way that will involve the least effort on the part of the reader to take them in. Spencer said that "Those are the most effective modes of expression which absorb the smallest amount of the recipient's attention in interpreting the symbols of thought, leaving the greatest amount for the thought itself." Technical articles naturally require rather close attention in reading but it is poor writing when a sentence or a passage must be reread two or three times to get at its meaning. Writing that leaves the reader's mind in such a condition that it can uninterruptedly follow the meaning of the paper without being conscious of the words has been described as good style. Huxley's idea of style was "to say that which has to be said in such language that you can stand cross-examination on each word."

Brevity. Brevity is another important quality of a technical paper. This does not mean that the presentation should not be adequate to a clear understanding of what is reported and ability of the reader to judge the merits of the contribution; but the length should be proportionate to the actual contribution. Nowhere are more skill and judgment required.

A publication is not judged by its length but by the message it carries. The amount of well-directed and well-digested work it represents, the discrimination shown in distinguishing between the important and the relatively unimportant, and conciseness in presenting the essential features are its claim to recognition.

Verbosity and diffuseness suggest a possible lack of really important matter to fill out the space, or at least that the writer has not digested what he has to say. As one writer puts it: "Verbosity is a sign either of carelessness or of a lack of time to take care."

The question of what to include will be determined to some extent by the character of the publication; but whether it is a technical or a semi-popular one, the question of what to leave out will be one for very careful consideration, which frequently can not be settled at the first writing. On review it may be found that considerable may be left out without sacrificing anything really essential. Descriptions and statements of facts gain force by brevity and by sticking quite closely to the real kernel of the subject.

As a rule, the more definitely a fact has been established by an investigation, the more directly and simply it can be presented. It is the doubtful ones that have to be hedged about with explanations, qualifications, and cautions.

On this subject of brevity Dr. Smith says: "A good rule is never to use two pages for a subject that can be compressed by a little thinking into one. The generality of men use more words to express an idea than are actually necessary, if the best words had been chosen. Study the meaning of words, their shades of meaning, and re-write a subject twenty times, if necessary, to state it cogently and with brevity. Remember: nearly everybody will read a brief statement on an interesting subject, while only the most phlegmatic and determined will hold themselves to a long-winded one. You will more than treble the number of your readers by halving your paper!

"Moreover, for the necessity of those who can't spend even the minimum of time necessary to read a short paper and for the convenience of everybody, especially of the foreigner, it is your solemn duty to sum up the substance of your contribution in a series of brief conclusions which everyone will read, and which, if well put, may induce

*Bacterial diseases of Plants, by E. F. Smith, pp. 643-7.

many to turn back and read your whole paper."

Style. The style of the technical paper should be simple, straightforward, and dignified. It should suggest neither a fairy tale, a sensational newspaper story, nor a sermon, but rather a simple, unaffected, and uncolored account of work done and its application. Accuracy and clearness ought never to be sacrificed to a supposedly more popular style. The presentation should be such as to win the reader's confidence in the thoroughness and reliability of the work reported.

Accuracy of fact and statement is, of course, a primary requirement in technical writing. Carelessness is intolerable, a reflection on the author which can not be shifted to the stenographer or the printer, even though these may be found at fault. The investigator who is careless in reporting his work lays himself open to the suspicion that he may be careless in his experiments, in taking data, and even in thinking about them.

Preparation of Manuscript

With these things in mind, what should be the method of preparing for publication? I have no new receipt, no suggestion that has not been made by others, but with this acknowledgment I may attempt to put into form some of the essentials we have been discussing.

In presenting a scientific paper or a bulletin the author says, by inference at least: "Here is the product of my labors upon this subject, taking advantage of what others have done and building upon that foundation. I present it because the work has reached a stage which marks an advancement worth recording. I give it to you in simple and straightforward form which will enable you to under stand the status of the subject, my contribution to it, and its bearing or application. It is the product of my investigation and my mature judgment. I am ready to stand by my work and to be judged by this account of it."

Schopenhauer divided writers into three groups. The first and largest group wrote without thinking; the second thought and wrote at the same time; and the third group, a very small one, thought before they even began to write.

Outline or Plan. It is a good idea, therefore, to begin with the making of an outline or plan to be followed in constructing the article. Order is the first law of nature; hence an account of research dealing with a study of nature ought to reflect this quality in its arrangement. One of the first requirements is that the paper should be systematic, orderly, and logical in its method of presentation, progressive in its effect, so that the course can be followed and interest will cumulate to the very end.

The Title. First in order will come the title. This can not always best be determined at the beginning, but it has to be provided for and so may be considered here. It is a matter of much more importance than it is sometimes thought to be. Of course there is a limit to what can be put into a title, but it should be specific and descriptive as far as it goes. Bibliographers complain bitterly of misleading or incomplete titles, and as bibliographies, abstracts, and indexes must be depended on for finding a paper after it is a few years old, an inadequate title is one means of burying a piece of research.

There have been several articles in "Science" recently on the proper wording of titles of scientific papers especially from the standpoint of the librarian and bibliographer. In one of these an earnest plea was made for such clear and definite titles as will enable the accurate cataloging of articles, so that the investigator must find them in his search for the literature.

The Introduction. Next will come the introduction, which, in an account of research, would set forth the problem and give a brief review of the recent literature bearing on the subject. Such a review should rarely constitute a monograph of all that can be found, as is sometimes the case, but be sufficient to show the status when the writer entered the field and the place where his work began. This will naturally make clear what the specific object of the research was—whether the adding of a new fact or idea, or a further interpretation.

This introductory matter will usually constitute a relatively small part of the article and be confined to what is strictly pertinent to the subject under discussion. It should not suggest what the old lady referred to as a "preramble". Dr. E. E. Slosson, of Science Service, gives the following advice in this connection: "Don't back up too far to get a running start. Remember the man who wanted to jump over a hill. He ran a mile to work up momentum and was so tired when he got to the bottom of the hill that he had to sit down and rest. So will your readers be. Ninety per cent of the manuscript that I have handled in twenty years as an editor would have been improved by cutting off the first page or paragraph. Yet authors, like hens, kick on decapitation."

Body of the Article. We are now ready for the account of the investigation itself. Begin at the beginning, and let the account unfold itself in a systematic, logical way, as a verbal account of some experience would, but with the possibility of doing even better. When we are talking we often revise a somewhat confused statement by "that is to say", or "in other words", which indicates dissatisfaction with the way the matter had been put, and that in translating his thoughts into words the speaker has clarified his own thinking. This correction will usually be taken care of in the revision.

The reader will naturally be interested in a brief statement of the plan of procedure, the method employed, an indication of the scope of the study and conditions under which it was done. The account will aim to show that the writer had a clear purpose in starting the work, realized what he was going after in his investigations, has the facts arranged in his own mind, and has studied them so that he can impart them to others and draw warranted deductions and conclusions.

To quote Dr. Slosson again, "Don't overestimate the reader's knowledge, and don't underestimate the reader's intelligence. He may not know as much as you do about this particular thing—let's hope not, anyway—but otherwise he may be as bright as you are—let's hope so anyway."

"Don't forget that your reader is interrupting you every ten lines to ask 'Why?', 'What for?' or 'Well, what of it?', and if you don't answer his tacit questions he will soon stop reading."

"Don't shoot in the air. Aim at somebody. You may miss him but you are more likely to hit somebody else than if you aim at nobody. Look out of your window and note the first person coming along the street. Imagine yourself stopping the man or woman on the sidewalk and, like the Ancient Mariner, holding his or her attention till you have told your tale to the end."

Analyse the subject carefully and break it up into parts. Use center heads and side heads in the text to divide it and express the relation of parts. This helps in the progressive arrangement and assists the reader to follow. Paragraph freely, separating different points in this way and bringing together things which belong together. This makes the page look less solid and makes reading easier.

As far as possible finish up each topic or phase of the subject as you go along. Do not revert to it further on in the text to add some new point. This makes confusion. When comparisons are made between different parts of the paper refresh the reader's mind sufficiently so that he will not necessarily have to turn back and reread in order to understand the new point.

Data and Tabular Matter. A preliminary step toward writing is the preparation of the data. It is often possible to work up the data as the investigation progresses from one stage to another. This is helpful in connection with deciding on the next steps. Before writing, the results will need to be critically reviewed to determine what they show and how they can best be arranged. The arrangement of data is an important part of the task of presenting the matter to someone else.

This occasion will be one of sifting, condensing, and summarizing. It is a selective process. I know there are those who contend for the publication of all the important data, so that readers may not only follow the author's reasoning but be able to check up critically on

his deductions. Some writers insist on a practical reproduction of their notebooks, but this seems rarely warranted or necessary. Liberality should be exercised, of course, but the permissible liberality is determined in no small measure by the character of the article. The main object is to record matters which have permanent value, confessedly a matter of good judgment in which there is perhaps as much danger of overestimating the importance of details as of leaving out too much.

The object of a table is to present a picture of the data, as complete in itself as possible. The purpose of tabulated data is not alone to record it, but to clarify the subject—to present the matter more clearly and concisely than it could be presented in the text. A table is a difficult thing for many people to make and for others to understand, particularly if it is unduly complicated or improperly constructed. The reader should be prepared for it by a text which leads up to it with a simple and direct explanation and a suitable title which tells what it is about. There is often room for improvement in such headings. Sometimes tables are designated merely by number. Do not cover too many different points in a single table. This makes the table complicated and leads to confusion, and it often results in including things which must be referred back to in the discussion several pages beyond. Long tables are apt to be confusing.

Try to avoid putting different units in the same column as pounds, tons, dollars, etc. Sometimes this is necessary, but usually it can be avoided by turning the table about. As far as possible tables ought to be self-explanatory, but sometimes the different treatments or variables are indicated by letters or numerals requiring reference to the text to supply the information, which usually is difficult. The table ought to clearly indicate the essential variables.

Don't forget that the reader will expect the author to make some explanation of what he considers a table shows, or how it prepares for what is to follow. It was not unusual in the past to "let the results speak for themselves," presenting them with no attempt at comments or comparison. Frequently this reflected a difficulty of interpretation, and so raised the question as to why such data should be inserted if the author himself was not able to make anything out of them.

Avoid qualifying unnecessarily or too extensively. The aim should be to make fairly definite statements regarding the teachings of the investigation. These may be limited in their scope, but they ought to be direct so that they can be understood. This is true whether they are conclusions, generalizations, or tentative suggestions. It is important to make the meaning clear, to be cautious and reserved, keeping well within the facts; but there is such a thing as being too cautious and too reserved, as if the author were not sure what he believed. It is a good rule to say what you have to say so people will give you credit for your suggestion or deduction; if not, it will be difficult to establish claim to originality later when someone else makes a positive announcement.

Illustrations. A good illustration is often the quickest way to convey an idea. Frequently it will do the work of a whole page of description. The same is true of the presensation of results in graphic form, provided such graphs are not so complicated as to require an undue amount of study. The object of illustrations is to illuminate the text but not to embellish it—to make it more intelligible, or to give a more definite impression. There is sometimes a tendency to overillustrate, which is a decided disadvantage in a scientific article. Aside from the expense this entails, it is confusing to the reader to be constantly running upon illustrations which are naturally supposed to have some bearing on the text, but after some waste of time are found not to have. Where possible there should be a reference to each figure or illustration in the text, and each figure should have a legend or title, telling what it illustrates and explaining it where necessary.

Conclusions. The reader will expect some conclusions. He may be suspicious if there are too many or if they are too far-reaching. The author here has the opportunity of crystalizing the results and showing how they clarify the subject. The important points developed in the investigation should be brought together, with such deductions, suggestions, or generalizations as seem warranted. The accurate drawing and stating of these conclusions is one of the most delicate steps in preparing a scientific paper, requiring not only caution and discrimination but unusual care in wording to avoid possible misunderstanding.

Editorial Review

After the paper has been entirely written, revise it clearly for the plan and method of presentation, and for the form of statement. This will frequently result in shortening the paper and making it more direct in its treatment, and it will give opportunity for the weighing of each statement for accuracy and clearness. If possible have some one else read it who has technical knowledge of the subject. Prefer criticism before rather than after publication. It is usually more agreeable.

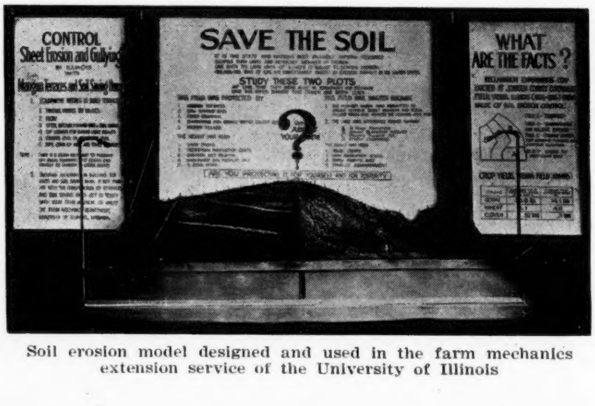
Most institutions or organizations now have provision for some editorial review of the manuscript before it is sent to the printer. The editor's task is a delicate one. It calls for tact, sympathy, and patience, but he is in a position to render a real service to writers of technical papers, and his efforts should be welcomed and given respectful consideration.

A Model to Promote Soil Erosion Control

THE soil erosion model shown in the accompanying illustration is one designed, built, and used by the farm mechanics extension service of the University of Illinois, which has been very helpful in promoting soil erosion control in the state. Eleven counties used the model in 1924 and questionnaires returned by eight farm advisers in these counties revealed the fact that the exhibit is very valuable from an educational standpoint. It was brought out in this connection that the exhibit tells the story of soil erosion control in a very satisfactory way, and there is evidence that the exhibit has been of value in stimulating an interest among farmers in soil erosion control.

The model fields shown in the illustration are each 34 inches square and are made of paper mache reinforced with hardware cloth. A sprinkling system is provided for these models to represent rainfall. The water is kept circulating by means of a small centrifugal pump driven by a one-quarter-horsepower electric motor. This feature of the exhibit is a most important one in attracting attention to it.

The printed panels tell the story which the exhibit is intended to bring out. These panels are so hinged that they fold up easily for boxing.



Soil erosion model designed and used in the farm mechanics extension service of the University of Illinois

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W. Trullinger, specialist in rural engineering, Office of Experiment Stations, U. S. Department of Agriculture

A Suggested Mechanism for Antiknock Action, O. L. Wendt and F. V. Grimm. (Industrial and Engineering Chemistry, Washington, D. C. 16 (1924), No. 9, pp. 890-893, fig. 1.) Studies are reported the results of which suggested tentatively that during an explosion in an automotive engine the explosive flame is propagated by the emission of electrons from the reacting molecules in that the advance of these electrons before the flame front ionizes and activates the unburned molecules, causing detonation at high temperatures and pressures. On this hypothesis the function of such materials as tetraethyl lead is to absorb electrons and to promote the recombination of ions previous to combustion, thus reducing the normal acceleration of the combustion rate.

It was found that tetrathyl lead and other antiknock compounds do actually have a marked effect in recombining gaseous ions at ordinary pressures and temperatures, while the knock inducers similarly tested have no effect. Attempts to reduce the rate of combustion by the application of magnetic and electrostatic fields were unsuccessful.

Size and Depth of Sand for Filters. (Engineering and Contracting, Water Works, Chicago 62 (1924), No. 4, pp. 827, 828.) The results of tests conducted by C. M. Daily on the size and depth of sand in seven water filters are briefly reported.

It was found that good water may be obtained with a 12-inch bed of sand by sacrificing the length of run through the use of fine sand. No sand finer than 0.38 millimeter is considered to be desirable in a filter bed, and sand coarser than 1 millimeter did not appear to be of any value. It is considered doubtful if any advantage is secured by having a greater depth than 24 inches of sand in a filter. Sand 24 inches deep composed of four layers, including (1) a 2-inch depth graded from 0.38 to 0.49 millimeters, (2) a 6-inch depth graded from 0.49 to 0.62 millimeters, (3) a 10-inch depth graded from 0.62 to 0.82 millimeters, and (4) a 6-inch depth graded from 0.82 to 1 millimeter, was found to give satisfactory results.

It was further found that where sand grains become coated with calcium deposits smaller sized grains should be used, and that the rate of filtration may influence the character of the effluent for any grading of sand. The effluent after washing was first clear, then became turbid, and after a period of from 30 to 45 minutes, running at one-fourth rate, became clear and remained so even after raising the rate until the tests were concluded. The best effluent was produced after 3 hours in service. It was found that the agar count in the effluent may not vary as the turbidity varies, but that it roughly follows the same changes.

Standard Specifications for Steel Highway Bridges. (U. S. Department of Agriculture Bulletin, Washington, D. C. 1259 (1924), pp. 48, figs. 7.) The text of standard specifications for steel highway bridges is presented, which were recommended by the subcommittee on bridges and structures of the American Association of State Highway Officials and approved by the Secretary of Agriculture for use in connection with the administration of federal appropriations for construction of the federal-aid highway system.

Domestic Sanitation and House Drainage, H. C. Adams. (London: Henry Frowde and Hodder & Stoughton, 1923, pp. XV+227, figs. 193.) This is one of the Oxford technical publications and consists of a large number of lectures presented to students by the author on sanitary science, particularly as applied to the household and to animal shelters. Chapters are included on building sites, sanitary building construction; house drains; drainage materials and fittings; construction of drains; soil and waste pipes; ventilation of drains; water-closets and slop sinks; baths, lavatories, and sinks; institution and school sanitation; cast-iron drainage; stables and cow sheds, drain flushing and cleaning; drain testing; planning drainage systems; conservancy systems; house refuse; drainage law; water services; lighting and illumination; warming; ventilation; and sanitary surveys.

A Survey of Two Hundred and One Privies for Intestinal Parasites, W. C. Boeck. (American Journal Public Health, Albany, N. Y. 14 (1924), No. 10, pp. 839-841.) In a contribution from the Harvard Medical School, data from an examination of excreta from two hundred and one privies in a southern community are reported, which revealed an incidence of infection with Endamoeba histolytica cysts of practically 5 per cent. The incidence of other protozoa and helminthic infections was sufficiently high to consider the situation surprising if not somewhat alarming. This infectious material is considered to constitute a potential danger to the community and to account for the greater prevalence of amoebic dysentery and helminthic infections among the people of the South as compared with those of the North where in general more adequate methods of excreta disposal are in force. The situation is considered to furnish an argument for continued rigid inspection of privies in the South, and for the extension of proper measures for excreta disposal.

Hydro-Electric Power as a By-Product of Agricultural Storage, E. N. Bryan. (American Society of Civil Engineers Proceedings, 51 (1925), No. 1, [pt. 3], pp. 80-92, figs. 3). In a contribution from the department of public works of the State of California, it is pointed out that large blocks of hydroelectric power are becoming available as a by-product in connection with the operation of irrigation storage works. This by-product has certain peculiar characteristics in that (1) it is the result of an advance during the past twenty-five years in the art of constructing high dams, (2) it is purely a by-product—not an end in itself, but merely an incident to the development of agricultural storage, (3) it has a seasonal distribution strikingly akin to the seasonal distribution of the demand for agricultural power, (4) to date there has been little progress in the provision of standby service, and (5) the producer of this energy is generally immune from regulation in the matter of rates anr service.

The ultimate total delivery of power by these by-product plants is considered to be relatively very important. This power supply is adapted especially to the satisfaction of a demand for irrigation pumping. In the case of three large projects with an abundance of water, the proposed ultimate installation is equivalent to that required for an irrigated area of equal size with an average lift of 90 feet. This by-product would, therefore, appear to open the way for irrigation of lands not heretofore thought susceptible of irrigation because of the cost of power.

The marketing of this by-product is considered to present some unusual and unsolved problems. At least three means of marketing are available, namely (1) the power might be sold wholesale at the generator switchboard to a utility at a price equivalent to only a relatively small part of the rate paid by actual consumers, (2) the producer may undertake the cost of standby service, distribution, and collection of accounts, and may then expect a much higher average rate, and (3) the project area may be increased so as to include a demand for a considerable block of the by-product power for irrigation pumping. It is pointed out that neither the cost of producing nor precedent establishes the sale value of such power, and the conditions which govern are not generally understood.

Certain dangers connected with this type of development are mentioned, such as false encouragement of premature and ill-considered irrigation development, the waste of water through low-head power plants along the lower reaches of the river, the destruction of capital by duplication of existing systems, and the lack of some disinterested regulative authority to stand between the producer and consumer in the matter of rates and service.

Emissive Tests of Paints for Decreasing or Increasing Heat Radiation from Surfaces, W. W. Coblentz and C. W. Hughes. (U. S. Department of Commerce, Bureau of Standards, Washington, D. C., Technol paper 254 (1924), pp. 171-187, fig. 1.) Experiments on the emissivity of heat from sheet iron, cotton duck, roofing material, artificial leather, and other fabrics covered with white paint, vitreous enamel, and aluminum paint are reported.

It was found that aluminum paint emits only from 30 to 50 per cent as much thermal radiation as the unpainted material, and as the white paint, vitreous glass enamel, or other nonmetallic coatings. The application of these data to house radiators is discussed. It is pointed out that owing to the fact that house radiators are essentially convectors of heat, a gain of only from 10 to 15 per cent in heat dissipation into the room may be expected by covering the surface of the radiator with a paint which is free from flakes of metals.

Agrological Studies, Soil Classification, and Physical Analysis of Soils [trans. title], L. A. R. da Silva. (Bulletin Ministerio Agricultura, Lisbon [Portugal], 5 (1922), No. 1-6, pp 127, figs. 4.) This is the second revised and enlarged edition of this contribution which deals with the mechanical, physical, and chemical properties of soils and their classification on these bases. Reference is made to methods of studying these properties, particularly those which are intended to evaluate some of the dynamic factors of soils such as tenacity, adhesion, etc. Tabular data are included, for instance, on the adhesion of soil to iron and wooden surfaces. Other data are included which should be of interest in a study of soil dynamics.

The Missing Pressure in Gas Engines, W. T. David. [Engineering [London], 118 (1924), No. 3070, pp. 623, 624, figs. 3.) Studies with closed vessels are reported which showed that the missing pressure, or so-called suppression of heat, in gaseous explosions is due to incomplete combustion, increasing specific heat, and heat loss to the walls of the vessel during the explosion period. The extent to which incomplete combustion contributed to the limiting of the pressures was not very different in the mixtures tested, but the extent to which the other two causes contributed to this varied considerably from mixture to mixture.

From a study of the application of the results of closed vessel experiments to the gas engine, it seemed improbable that combustion factors greater than about 70 per cent are realized in gas engines with normal ignition. The belief is expressed that in gas engines with normal ignition, the maximum pressure occurs gen-

erally more or less in the neighborhood of the amount of complete inflammation, which marks the end of the period of the maximum rate of rise of pressure in the closed vessel. After-burning then continues during the expansion stroke.

The defect of the actual efficiency from the ideal efficiency appears to be due mainly to the rapid heat flow into the cylinder walls in the case of strong mixtures and to slow inflammation and after-burning in the case of weak mixtures.

Heat Loss in Gas Engines, W. T. David. (Engineering [London], 118 (1924), No. 3070, pp. 629, 630, figs. 8.) Studies of the radiation and conduction losses during the explosion and subsequent cooling of inflammable mixtures of coal gas and air in a closed vessel are reported.

The results, of importance in gas engine design, which were observed were (1) the emphasis on the very marked influence of temperature upon the heat loss from the working fluid both by conduction and radiation, and (2) the indication that the radiation per unit area of wall surface increases greatly with cylinder dimensions.

It was found that the intrinsic radiance at the maximum temperature developed varies very approximately as the square root of the cylinder dimensions. This, while the conduction loss from the hot gaseous mixture at any given temperature over the entire surface of the vessel varies as the square of the cylinder dimensions, the loss of heat by radiation from the hot mixture at any temperature over the entire surface of the vessel varies as the five halves power of the cylinder dimensions.

An application of these results to the gas engine is outlined with special reference to the effect of cylinder dimensions upon heat loss. It is brought out that, similarly to the closed vessel, the heat loss per unit area of wall surface increases with the cylinder dimensions in the case of gas engines working under similar conditions of mixture strength and speed.

The Iodine Content of Michigan Water Supplies, E. F. Eldridge. (American Journal of Public Health, Albany, N. Y. 14 (1924), No. 9, pp. 750-745, figs. 2.) Studies of the iodine content of the water supplies of Michigan conducted in connection with a survey of the goiter situation in that state are briefly reported.

Contrary to expectations, a number of places were found in the state where the ground water supplies contained some iodine. These places include a strip of counties running northwest and southeast between and including Midland, Macomb, and Saginaw. In general these counties are the high iodine counties of the state, and at no other place was iodine found in amounts above three parts per billion. No iodine was found in any of the ground water supplies of the northern peninsula nor the upper part of the lower peninsula, and none of the surface water supplies examined showed a trace of iodine except those of the Great Lakes. A few of the mineral waters and brines showed a great variation, depending upon location and depth.

It is noted that, although iodine increased with chlorine, there was no definite ratio between the two, and the amounts present seemed to depend upon the location and depth from which the sample was taken. Bromides were also present where iodine was found.

Thawing Frozen Water Pipes With Electric Current, D. D. Ewing and C. F. Bowman. (Purdue University Engineering Extension Service Bulletin, Lafayette 7 (1924), pp. 16, figs. 10.) A summary of present practices in the thawing of frozen water pipes with electric current is presented, together with lists of the equipment required for some of the arrangements that have proven successful. Data on the electrical characteristics of certain small sizes of commercial steel pipes are also presented.

Artificial Illumination of Poultry Houses for Winter Egg Production, F. L. Fairbanks. New York Agricultural College (Cornell) Extension Bulletin 90 (1924), pp. 28, figs 19.) Data for two years' studies on the artificial illumination of poultry houses for winter egg production are reported and discussed.

The results indicate that the general illumination of the pen is quite as important as the illumination of the floor. It was found that even with the proper intensity of light on the feeding floor a number of the birds did not come down to feed if the perches were dark, but that when the lighting unit was changed so as to throw light on the perches, and at the same time keep the proper floor intensity, all the birds came down to feed. The details of the electrical apparatus used are presented. It was found that to find the number of lighting units that will be required for a pen of a given size, the number of square feet of floor space should be divided by 200, the nearest whole number will be the number of units required. The lighting units should be placed 6 feet from the floor and 10 feet apart along a line midway between the front of the house and the front of the dropping board.

The Theory of the Mechanical Analysis of Sediments by Means of the Automatic Balance, R. A. Fisher and S. Oden. (Royal Society Edinburgh Proceedings, 44 (1923-24), No. 2, pp. 98-115, fig. 1.) A simplified mathematical statement of the theory of sedimentation through a stationary fluid is presented, which leads to the formula originally indicated by Oden, and shows that the characteristic distribution of the sediment may be obtained (1) from the variation of density with depth, (2) from the rate of change of density at a given depth, (3) from the variation of hydrostatic pressure with depth, and (4) from the rate of change of hydrostatic pressure at a given depth. Schloesing's sedimentation theory is considered to be incomplete and to lead to large errors in the interpretation of observations.

A discussion is given of the statistical problems arising in the reduction of sedimentation data derived from the automatic balance, and examples of such data from two duplicate experiments are utilized to reveal the experimental errors involved.

Two types of fluid motion appeared to influence the results. The first of these was a vertical circulation set up by the initial disturbances. In the second of these two types of fluid motion it with errors indicated by the experiments as occurring during the first 100 minutes of sedimentation. This disturbance could be remedied by using fluids of higher viscosity, especially as this procedure increased the time taken by the coarser particles to settle, in addition to reducing the time necessary to obliterate the initial disturbance. In the second of these two types of fluid motion it was found that convection currents of unspecified type will become important in prolonged experiments where the finer particles are being studied. Great experimental refinement may be necessary to avoid these, and their effect should be much reduced by maintaining the temperature of the water as closely as possible to that corresponding to its maximum density.

Effect of Temperature Upon Friction of Water in Pipes, F. E. Giesbecke. (Journal American Society of Heating and Ventilating Engin., Easton, Pa. 30 (1924), No. 12, pp. 747-752, figs. 3.) In a contribution from the University of Texas a summary is given of data from hydraulic experiments, indicating the effect of temperature upon the friction of water in pipes. Tabular data to illustrate the results are included.

The Protection of Wells Used as a Source of Domestic Water Supply. (Ontario Board of Health Annual Report, Toronto 42 (1923), pp. 147-150.) The results of sanitary surveys of a large number of private wells are tabulated, indicating that the number of dug wells of fair quality is very small, especially where no pumps or only wooden tops are provided. Dug wells with concrete tops showed an improvement, although it is evident that concrete tops were not always supplemented by water tight walls and gutters. Drilled and driven wells showed a decided improvement, although it is noted that the percentage of fair quality wells might be increased by better attention to the casings and tops.

Test of Lubricating Oils, (U. S. Navy Department, Bureau of Engineering, 1924, pp. 17.) Instructions for conducting service tests of lubricating oils in the laboratory as practiced at the engineering experiment station at Annapolis, Maryland, are presented.

A. S. T. M. Standards, 1924, (Philadelphia: American Society Testing Materials, 1924, pp. 1219, pls. 5, figs. [175].) This volume contains the two hundred and twenty stand rd specifications, methods of test, definitions of terms, and recommended practices in effect at the time of its publication as established by the American Society of Testing Materials.

A. S. M. E. Boiler Construction Code, 1924, (New York: American Society of Mechanical Engineers, 1924, pp. [8]+198, pl. 1, figs. 42.) Standard rules are presented for the construction of stationary steam boilers, which are known collectively as the A. S. M. E. boiler construction code formulated by the boiler committee of the American Society of Mechanical Engineers. These regulations deal with power boilers, material specifications, and rules for inspection.

Use of Headers in Algeria, C. Clarou, (Utilisation des Espicadoras en Algerie. Algiers: Gouvt. Gen. Algerie, Dir. Agr., Com. et Colon., 1921, pp. 32, pls. 4, figs. 6.) A description is given of the use of headers in the harvesting of grain in Algeria, which includes a brief outline of the mechanical details of the machines used and their manner of operation.

Modern Road Construction and Maintenance, H. E. Goldsmith. (Hongkong: Kelly & Walsh, Ltd., 1923, 2 ed., rev. and enl., pp XVIII+252, pls. 16, figs. 9.) This is the second revised and enlarged edition of this book, the purpose of which is to record the improvements which are daily being discovered in the methods of modern road construction and maintenance, with special reference to tropical conditions. It is stated that much of the material used in the text has been prepared from notes made in carrying out improvements to the highways of the Colony of Hongkong, and from various conferences in connection with modern road construction attended by the author in England, Australia, and America.

Chapters are included on new roads, with particular reference to the work required in opening up undeveloped country in hilly districts; setting out work; footpaths, curbing, and channeling; asphalt; asphalt macadam; asphaltic concrete; sheet asphalt; bituminous treatment of surfacing; water-bound macadam; tar macadam; concrete roads; rubber roads; methods of selecting and forwarding samples; tools required for use in asphaltic works; and testing materials. Three appendixes are included.

Book Review

"The Boy and His Vocation," by John Irving Sowers, director of vocational education, Miami, Florida, is the title of a new book which is the result of years of experience working with and acting as counselor for boys. The matter of vocational and life guidance, according to the experience of the author, needs to be inspirational and stimulating as well as didactic. The author's aim is to submit such common things as work, character, thrift, health, and citizenship to the boy in language that he can understand, and in such form that he can use the knowledge with profit now. The material as presented has been found to function best when used as a vocational reader in the eighth and ninth grades. The book contains chapters on the boy on the fence, education, the blazed trail, choosing a vocation, health and efficiency, citizenship, and selling your ability. The book contains 197 pages and is published by The Manual Arts Press, Peoria, Ills. The price is $1.50.

Plans For Annual Meeting At Madison

THE program is rapidly being completed for the nineteenth annual meeting of the American Society of Agricultural Engineers to be held at Madison, Wisconsin, June 22, 23, 24, and 25, 1925. The tentative program of the meeting will be found on another page of this issue.

The Meetings Committee and the Committee on Local Arrangements have been working for months planning and preparing for this great annual get-together of agricultural engineers. Following the plan inaugurated in connection with the annual meeting a year ago, the first day, June 22, will be devoted to inspection tours, demonstrations, committee meetings, etc. Beginning at nine o'clock in the morning a group of the staff of the U. S. D. A. Forest Products Laboratory will meet the convention guests and conduct them on a three-hour tour through the laboratory. Research work in wood preservation, box making, paper making, lumber drying, and many other lines of work are constantly in progress in this laboratory, and special demonstrations will be put on for the benefit of those attending the meeting.

The Forest Products Laboratory is the only one of its kind in the country and the scientific staff includes more than a hundred men. It was in this laboratory that most of the experimental work was done in developing the right design for the airplane propeller, and it was in this laboratory that the first silk thread was made out of wood fiber. Here also a method of kiln drying of lumber was developed, which today is saving the lumber industry of the country fifteen million dollars annually, because it is now possible to dry lumber just as thoroughly in ten days as it was formerly in ten months.

At 1:30 in the afternoon of June 22 a series of demonstrations on the University of Wisconsin Farm will be conducted by members of the agricultural engineering staff.

A subject of special interest in this connection is the University marsh, the surface of which is about a foot and a half lower than the surface of Lake Mendota. The marsh consists of 110 acres and is drained by a 15-inch auger pump propelled by a 15-horsepower electric motor. The installation of the drainage system has been in progress for about ten years and is now practically complete. It is on this marsh that all the corn is now raised to fill the ten silos on the University Farm.

Other demonstrations and inspection tours for the afternoon of June 22 include a demonstration of plowing a tough marsh sod with a special marsh plow and tractor equipped with special lugs for marsh land; a demonstration of mud capping for rock blasting; a demonstration of ditch blasting in which a real ditch will be shot by a group of farmers near Madison; inspection of the belt dynamometer used on a silo filler for cutting green alfalfa and elevating it into the silo; a horse pulling contest, and general inspection of the University of Wisconsin Farm.

There is scheduled for 7:00 P. M. of June 22 a dinner and conference of heads of departments of agricultural engineering at land-grant institutions. At this conference the subjects for discussion will include (1) an agricultural engineering institute at Davis, California, July 1926; (2) whether or not members of agricultural engineering staffs should be members of the Society; (3) the advisability of having an official visitor for agricultural engineering departments; (4) the relation of the agricultural engineering department to the other departments of the colleges; (5) policy of having agricultural engineering departments conduct research and extension as well as resident teaching; (6) how to stimulate the growth of staff members, etc. This conference will be presided over by Dan Scoates, chairman of the College Division of the Society.

In addition to the foregoing, arrangements will be made for committee meetings, conferences, etc., to be held on June 22, special arrangements for which should be made with the Secretary of the Society in advance of the meeting.

Instead of the entire convention convening at a general session to listen to speakers of national prominence in the middle of the day, the second day of the meeting will be devoted entirely to programs of the professional divisions, and the third day will be devoted to a general program featuring speakers of national prominence and subjects of special interest to all agricultural engineers. It is felt that this change in the plan over last year will be a great improvement, as it will not break into the division programs, and each division will be given a full day in which to present its program.

The entire second day, June 23, of the meeting, therefore, will be devoted to all-day programs of the Farm Power and Machinery Division, the Land Reclamation Division, and the Farm Structures Division, which will be presided over by the chairmen of the respective divisions. The programs of the three divisions appearing elsewhere in this issue schedule subjects of timely interest and importance to agricultural engineers in the different fields.

Arrangements have been made for a get-together dinner and round-table discussion starting at 6:00 P. M., June 23, for agricultural engineers engaged in extension work at land-grant institutions. At 8:00 P. M. on June 23 the annual business meeting of the Society will be held.

The third day of the meeting, June 24, will be devoted to a general program, which will feature addresses of particular interest to all agricultural engineers. The meeting will be called to order by E. R. Jones, chairman of the Committee on Local Arrangements, who will turn the meeting over to President H. B. Walker. Memorial services for the late Prof. F. W. Ives, who was elected eighteenth president of the Society but who was fatally injured in a railway accident immediately following his taking office, will then be held.

Following the memorial services the President's annual address will be delivered by President Walker. Addresses scheduled for the remainder of the day's program are as follows:

There will be an address by Arthur Huntington, of the Iowa Railway and Light Company, on "Some Problems in Rural Electrification."

The president of the National Association of Farm Equipment Manufacturers, Finley P. Mount, president of Advance-Rumely Company, will address the convention on the subject "The Agricultural Engineer and the Farm Equipment Industry."

Dan Scoates, professor of agricultural engineering, at the Texas A. and M. College, will relate his personal observations of engineering development in European agriculture.

The annual report of the Committee on Agricultural Engineering Research, which is always looked forward to with a great deal of interest by agricultural engineers and which is a summary of the year's progress in the development of agricultural-engineering research, will be presented by the chairman of the committee, R. W. Trullinger, specialist in rural engineering, Office of Experiment Stations, U. S. Department of Agriculture.

An address entitled "Farm and Factory Related" will be delivered by H. L. Russell, dean of agriculture at the University of Wisconsin. He has held that position since 1908 and at the present time he is the oldest dean of agriculture in the point of service in this country. He has spent years collecting information which will serve as the basis of his address on the relation between agriculture and other industries.

Rafael Zon, director of Lake States Experiment Station, will address the convention on the subject "Engineering Aspects of Some Forestry Problems." Mr. Zon is a fellow of the American Forestry Association and author of "Forest Resources of the World," and many other pub-

(Continued on page 113)

Tentative Program of the 19th Annual Meeting of the American Society of Agricultural Engineers

Madison, Wisconsin—June 22, 23, 24, and 25, 1925

First Day—June 22

9:00 A. M. Three-hour tour through the Forest Products Laboratory of the U. S. Department of Agriculture. In connection with this tour special demonstrations will be put on for the benefit of the guests.

1:30 P. M. Inspection trips and demonstrations on the University Farm to be conducted by members of the agricultural-engineering staff, as follows:

(1) Inspection of the University marsh and its drainage system.

(2) Demonstration of plowing tough marsh sod with special marsh plow.

(3) Demonstration of mud capping for rock blasting.

(4) Demonstration of ditch blasting, in which a real ditch will be shot by a group of farmers.

(5) Demonstration of the use of the belt dynamometer on a silo filler cutting and elevating green alfalfa into silo.

(6) Horse pulling contest between two good teams on the University Farm.

(7) Inspection of the University of Wisconsin Farm.

7:00 P. M. Dinner and conference of heads of departments of agricultural engineering at the land-grant colleges.

In addition to the foregoing there will be committee meetings, conferences, etc., special arrangements for which should be made with the Secretary of the Society well in advance of the meeting.

Second Day—June 23

FARM POWER AND MACHINERY PROGRAM

Morning Session—9:00 A. M.

PAPER: "Depreciation of Farm Machinery"—Lew Wallace, Iowa State College.

PAPER: "Equipment for Handling Marl"—H. H. Musselman, Michigan State College.

PAPER: "Operation of Wind Electric Plants"—F. C. Fenton, Iowa State College.

PAPER: "Equipment for Treating Wheat"—Geo. W. Kable, Oregon Agricultural College.

REPORT: Committee on Farm Products—H. R. Burr, Waunakee Canning Co., chairman.

Afternoon Session—1:30 P. M.

PAPER: "The Present Status of Power Farming"—A. P. Yerkes, International Harvester Co.

PAPER: "Relation of Agricultural Engineering to Better Grades and Higher Prices of Grain"—R. H. Black, U. S. D. A. Office of Grain Cleaning Investigations.

RECLAMATION PROGRAM

Morning Session—9:00 A. M.

PAPER: "Actual Results of Timber Growing in Michigan"—E. G. Amos, county agent leader, Upper Peninsula of Michigan.

PAPER: (On irrigation, subject to be announced)—S. H. Beckett, University of California.

REPORT: Committee on Drainage—J. R. Haswell, chairman.

REPORT: Committee on Land Colonization—David Weeks, chairman.

Afternoon Session—1:30 P. M.

PAPER: "The Michigan Land Economic Survey"—H. J. Andrews, director.

PAPER: "Value of War Explosives Distribution"—Geo. R. Boyd, U. S. Department of Agriculture.

REPORT: Committee on Permanent Timber Supply—H. H. Musselman, chairman.

REPORT: Committee on Land Clearing—L. F. Livingston, chairman.

REPORT: Committee on Soil Erosion—E. W. Lehmann, chairman.

FARM STRUCTURES PROGRAM

Morning Session—9:00 A. M.

PAPER: "Factors Influencing Flue Velocities"—M. A. R. Kelley, U. S. Department of Agriculture.

PAPER: "Poultry House Ventilation"—C. W. Smith, University of Nebraska.

PAPER: "Automatic Temperature Control for Poultry Houses"—D. G. Carter, University of Arkansas.

Afternoon Session—1:30 P. M.

PAPER: "Practical Dairy Barn Planning"—Howard T. Greene, farmer, Genesee Depot, Wisconsin.

PAPER: "Preservative Treatment for Fence Posts"—G. L. Hunt, U. S. D. A. Forest Products Laboratory.

REPORT: Committee on Farm Building Design—W. A. Foster, chairman.

REPORT: Committee on Farm Building Code—W. G. Ward, chairman.

Evening Program—June 23

6:00 P. M. Get-together dinner and round-table discussion for extension agricultural engineers.

8:00 P. M. Annual Business Meeting.

Third Day—June 24

GENERAL PROGRAM

Morning Session—9:00 A. M.

Meeting called to order by E. R. Jones, chairman, Committee on Local Arrangements.

Memorial services for the late Prof. F. W. Ives.

President's Annual Address—H. B. Walker, Kansas State Agricultural College.

ADDRESS: "Engineering Aspects of Some Forestry Problems"—Raphael Zon, director, Lake States Forest Experiment Station.

ADDRESS: "Relation of the Agricultural Engineer to Land Economics"—Dr. Richard T. Ely, University of Wisconsin.

ADDRESS: "European Observations of an Agricultural Engineer"—Dan Scoates, Texas A. & M. College.

REPORT: Committee on Agricultural Engineering Research—R. W. Trullinger, chairman.

Afternoon Session—1:30 P. M.

ADDRESS: "Farm and Factory Related"—H. L. Russell, dean of agriculture, University of Wisconsin.

ADDRESS: "The Agricultural Engineer and the Farm Equipment Industry"—Finley P. Mount, president, National Association of Farm Equipment Manufacturers.

ADDRESS: "Relation of Agricultural Engineering to Agricultural Development"—James R. Howard, Iowa farmer and first president of the American Farm Bureau Federation.

ADDRESS: "Some Problems in Rural Electrification"—Arthur Huntington, Iowa Railway and Light Company.

ADDRESS: "A Foreigner's Viewpoint on Agricultural Engineering Development in America"—Dr. George Kuehne, professor of agricultural machinery, Munich Technical Academy, Germany.

Evening Program—June 24

7:00 P. M. Annual Banquet and Get-Together.

Fourth Day—June 25

COLLEGE DIVISION PROGRAM

Morning Session—9:00 A. M.

PAPER: "Summary of Papers on Agricultural Engineering Education of Previous Years"—C. O. Reed, Ohio State University.

PAPER: "Redirection of Teaching Procedure in the Light of Modern Psychology"—H. W. Nisonger, Ohio State University.

Reports of Committees of College Division—(Summary of reports presented by chairmen and limited to 10 minutes. Discussion of each report to be limited to 15 minutes.)

Afternoon Session—1:30 P. M.

Cooperative Relationships

PAPER: "Opportunities and Requirements for Cooperation"—H. B. Walker, Kansas State Agricultural College.

DISCUSSION: Cooperation with Farm Equipment Industry—led by J. B. Davidson, Iowa State College, and F. A. Wirt, J. I. Case Threshing Machine Co.

DISCUSSOION: Cooperation with the Electrical Industry—led by S. H. McCrory, U. S. Department of Agriculture, and B. D. Moses, University of California.

DISCUSSION: Cooperation with Building Materials Industry—led by Dan Scoates, Texas A. & M. College, and W. G. Ward, Kansas State Agricultural College.

DISCUSSION: Cooperative Education—led by O. W. Sjogren, University of Nebraska, and G. W. Iverson, Advance-Rumely Co.

DISCUSSION: Cooperation in Research—led by L. J. Fletcher, University of California, and M. L. Nichols, Alabama Polytechnic Institute.

GENERAL DISCUSSION.

Evening Program—June 25

8:00 P. M. Meeting of the Council of the Society.

Plans for Annual Meeting at Madison

(Continued on page 111)

lications on forestry. He is recognized as one of the leading forestry engineers in the country.

Dr. George Kuehne, professor of agricultural machinery at the Technical Academy, Munich, Germany, is on a tour of investigation in this country and will address the convention along the lines of a foreigner's viewpoint on agricultural engineering developments in America.

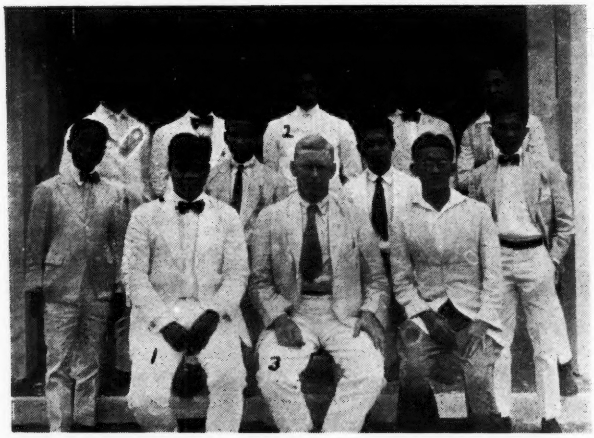
An address of special significance to agricultural engineers is that entitled "Relation of the Agricultural Engineer to Land Economics," by Dr. Richard T. Ely, professor of economics, University of Wisconsin. In recent years he has devoted particular attention to the study of land economics and has organized the institute for research in that subject with headquarters at Madison. His message to the convention will be based on the findings of the institute insofar as they affect agricultural engineers.

James R. Howard, Iowa farmer and first president of the American Farm Bureau Federation, will address the convention on the subject "Relation of the Agricultural Engineer to Agricultural Development."

The climax of the annual meetings of the American Society of Agricultural Engineers, so far as interest and enthusiasm is concerned, is reached with the holding of the annual banquet on the evening of the third day, which this year is scheduled for 7:00 P. M. of June 24.

The fourth day of the meeting, June 25, will be devoted exclusively to a program of the College Division of the Society. Two papers, "Summary of Papers on Agricultural Engineering Education of Previous Years" by C. O. Reed, professor of agricultural engineering at Ohio State University, and "Redirection of Teaching Procedure in the Light of Modern Psychology," by H. W. Nisonger, of Ohio State University, will feature the morning session of that day. In addition to this reports of the committees of the College Division will be summarized by the respective chairmen, each chairman being limited to ten minutes in which to present the report of his committee. The discussion following each report will be limited to a total of fifteen minutes.

The afternoon session of the College Division program will be devoted exclusively to cooperative relationships. The various discussions will be preceded by a formal paper entitled "Opportunities and Requirements for Cooperation," by H. B. Walker, professor of agricultural engineering at the Kansas State Agricultural College, and president of the Society. This will be followed by discussions on cooperation with the farm-equipment industry, the electrical industry, and the buildings materials industry, and cooperation in education and research.



This is a picture of the rural engineering staff of the University of the Philippines, College of Agriculture, Los Banos, P. I. No. 1 is A. L. Teodoro (Assoc. Mem. A. S. A. E.) No. 2 is Alex Gordon (Jun. Mem. A. S. A. E.) now a pensionado to the states studying at Cornell University, and No. 3 is C. P. Johnson (Assoc. Mem. A. S. A. E.) professor and head of the department

Of special interest to agricultural engineers attending the meeting is the two-day conference, on June 26 and 27, on rural electrification which will be held at Madison under the auspices of the national Committee on the Relation of Electricity to Agriculture.

Convention Arrangements

Hotel Loraine, Madison, will be headquarters during the annual meeting. All those attending the meeting and desiring reservations should write direct to the hotel management. Other hotels at which those attending the meeting may secure accommodations are the Park Hotel, Hotel Belmont, Capitol Hotel, and Monona Hotel, all of which are on the European plan.

The Committee on Local Arrangements has arranged for the renting of tents at from $3.00 to $8.00 a week. The University has a splendid camping ground for the use of which no charge will be made to those attending the convention. There will also be a number of lakeside cottages available for rental at from $20.00 to $40.00 per week. These cottages are equipped with beds and mattresses, but guests will supply their own bedding and linen. Dishes and cooking utensils are furnished with the cottage. It will be necessary for parties to have automobiles if they make use of the camping site or rent lakeside cottages.

The general sessions on Wednesday, June 24, will be held in the auditorium of Agricultural Hall. The division meetings on Tuesday and Thursday, June 23 and 25, will be held in the lecture room of the Agricultural Engineering Building.

Special taxicab service will be provided from the hotel to the University just before a regular session opens. The street car line also furnishes a direct connection with a ten-minute schedule from the depots and hotels to the college.

There will be a registration desk with an attendant in the lobby of Hotel Loraine and also one in the general offices of the Agricultural Engineering Building. Those attending the convention are urged immediately to register upon reaching Madison so that their comfort, entertainment, etc., may be promptly and adequately provided for.

Pacific Coast Section Meeting

All members of the Society, and especially those who reside in the territory of the Pacific Coast Section, are invited to attend a meeting of the Pacific Coast Section which will be held at the Hotel Clark, Los Angeles, California, on May 29.

A business session will be held at 3:00 P. M. At a dinner meeting in the evening three papers will be presented.

Prof. David Weeks of the Division of Rural Institutions, University of California, will present a paper on his "Survey of the Spanish Springs Reclamation Project in Nevada."

Max E. Cook, of the California Redwood Association, will present a paper on "Real Economy in Farm Building Construction."

Prof. B. D. Moses, who is executive secretary of the California Committee on the Relation of Electricity to Agriculture, will present a report on "Interesting Phases of the Rural Electrical Investigations in California."

At least one, and perhaps two, of these papers will be illustrated with slides.

The main business for the afternoon session is the discussion of the plans for the 1926 annual meeting of the Society. The dates for this meeting are June 23-26, and the meeting place will be at Tahoe Tavern, Lake Tahoe. A very interesting inspection trip is being planned for four or five days after the meeting. This trip will include a visit to at least two of the most important hydro-electric plants in the state, the Durham State Land Colony, the Delta Region near Stockton, known as the Holland of America, and one or two irrigation districts in the San Joaquin Valley.

Of special interest to agricultural engineers will be the extensive use of power-farming equipment, electric energy on the farms and specialized farm structures.

The Tractor Meeting At Chicago

WHAT was unquestionably the most outstanding tractor meeting ever held in the history of the tractor industry was the national tractor meeting held under the auspices of the Farm Power and Machinery Division of the American Society of Agricultural Engineers and the Farm Equipment Division of the Society of Automotive Engineers at the Great Northern Hotel, Chicago, April 29 and 30.

The program for the first day, April 29, was presented under the auspices of the American Society of Agricultural Engineers and was devoted exclusively to the agricultural application of the tractor. F. A. Wirt, chairman of the Farm Power and Machinery Division of the Society, presided at the meeting which proved intensely interesting and instructive from start to finish. The meeting was particularly outstanding as to the amount of time available for discussion of the various papers presented and many favorable comments were heard following the meeting.

The meeting opened with the presentation of a paper entitled "Apparatus for Testing the Efficiency of Tractor Wheel Lugs", by Edgar V. Collins, assistant chief of the agricultural-engineering section of the Iowa Agricultural Experiment Station. The presentation of this paper was followed by a very interesting discussion on the subject of tractor wheel lugs, which brought out the fact that the question of lugs is perhaps the biggest and most troublesome factor in tractor design at the present time, and that a great deal of research was necessary in the solution of this problem. Following this a discussion on the subject, "Some Needed Tractor Research", was opened by O. W. Sjogren, professor of agricultural engineering at the University of Nebraska, representing the Research Committee of the Society. Because of the great amount of testing of tractors with which Prof. Sjogren has been associated in connection with the Nebraska tractor tests, he was particularly well qualified to discuss the subject of needed tractor research and his discussion of the subject was listened to with a great deal of interest and profit by the tractor men in attendance. A very lively discussion followed Prof. Sjogren's talk, which brought out some very interesting points for the tractor men to think about.

In connection with the discussion on tractor research, Chairman Wirt called on the president of the Society, H. B. Walker, professor of agricultural engineering at the Kansas State Agricultural College. President Walker delivered a very inspirational talk on tractor research, pointing the logical way in which the industry might proceed in carrying out a program of research, and he outlined particularly how the industry and the land grant colleges and experiment stations could cooperate in working out problems of research.

Following the discussion on tractor research a motion was made and passed by the meeting urging that, at the request of the Farm Power and Machinery Division, the Research Committee of the Society take up the question of the use of alcohol as a fuel in tractor and other farm engines. While the discussion in connection with the possibilities of alcohol fuel in tractors was not extensive, it showed that there was a very keen interest in its possibilities.

On the suggestion of L. R. Clausen, president of the J. I .Case Threshing Machine Company, who pointed out that a proper subject for investigation by a committee of the Society to take up the question of cost accounting in order to determine what actual production costs on the farm are, which he stated was very necessary along with equipment, a motion was made and carried that proper methods of cost accounting in farm production be undertaken by a committee of the Society.

The morning session was followed by a tractor luncheon and good fellowship get-together of those in attendance at the meeting. At the luncheon Dr. Otto Philipp, director of the Institute for Agricultural Machinery of Landsberg, Germany, spoke briefly on the work his institution is doing in promoting the use and improvement of farm machinery. A short address was given also by President Walker, of the Society.

The afternoon session of April 29 was opened with the presentation of a paper entitled "The Power Take-Off for Tractors", by F. N. G. Kranich, manager of the tractor and implement bearings department of the Timken Roller Bearing Company. This topic is unquestionably one of the most important ones in the tractor industry today and the presentation of Mr. Kranich's paper was followed by a very interesting discussion on the subject, which was led by A. W. Scarratt, tractor engineer of the Minneapolis Steel and Machinery Company.

A paper that stimulated lively discussion was presented by L. H. Letz, chief engineer of the Letz Manufacturing Company, entitled "Universal Belt Speeds for Tractors." Unfortunately, however, there was not sufficient time available to discuss all the points which Mr. Letz had presented. As a matter of fact, the subject is one which is giving farm equipment manufacturers, particularly the builders of belt-driven machinery, a great deal of concern, because the lack of a universal belt speed requires that the manufacturers of belt-driven machinery carry a large variety of pulleys in stock. It was suggested at the meeting that an informal conference on belt speeds be held some time during the summer for the purpose of endeavoring to arrive at a solution of the problem.

The chairman of the Committee on Belting for Farm Machinery, John Mainland of the Advance-Rumely Company, presented a report for his committee in which were featured proposed standards for main drive belts for farm machinery.

The evening session of April 29 was devoted to the showing of motion picture films, which included a two-reel film showing modern tractor production in the plant of the International Harvester Company and several films showing agricultural, road, and industrial uses of the tractor.

The second day of the meeting, April 30, was under the auspices of the Society of Automotive Engineers and was confined to a discussion of subjects coming within the scope of internal-combustion engineering as applied to tractors. O. B. Zimmerman, of the International Harvester Company and chairman of the Farm Power and Equipment Division of the Society of Automotive Engineers, presided at the meeting.

The morning session of the meeting opened with a discussion of the subject "Influence of Tractor Engine Development on Automobile, Truck, and Gas Engine Design." This discussion was participated in by several leading engineers in the tractor industry and some very interesting points were brought out.

The second paper on the morning program was presented by Col. George D. Babcock, of the Holt Manufacturing Company, on "Recent Developments in Production Methods and Equipment."

Practically all those in attendance attended the tractor luncheon and listened with a great deal of interest to addresses by A. W. Fitzpatrick, manager of the educational department of the Hart-Parr Company, and H. L. Horning, president of the Waukesha Motor Company and president of the Society of Automotive Engineers.

Following the luncheon, and as the first number on the afternoon program, Mr. Horning presented a most interesting paper entitled "Needed Research on Tractor Engines," which stimulated a great deal of interesting and valuable discussion.

The afternoon session was concluded by the presentation and discussion of a paper entitled "The Calculation and Design of Coil Springs," by E. W. Stewart, engineer, William D. Gibson Spring Company.

Organization Meeting of North Atlantic Section

A PETITION having been signed by the required number of members and duly approved by the Council of the Society, for permission to organize the North Atlantic Section of the American Society of Agricultural Engineers, a meeting to formally organize the section was held at Cornell University, Ithaca, New York, April 10 and 11.

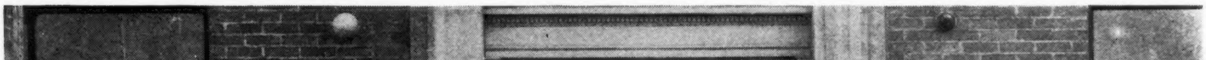
The business meeting to consider the advisability of the organization of the North Atlantic Section of the Society was not held until near the close of the first day's session, after those in attendance had listened to some very interesting papers, informal talks, and particularly to discussions of agricultural-engineering problems facing engineers in the territory included within the scope of the proposed section. By that time there was no doubt as to the need of the section and its organization was undertaken with a great deal of enthusiasm. As a matter of fact the meeting was outstanding with respect to the enthusiasm and intense interest manifested by all in attendance. About two-thirds of those attending the meeting were members of the Society, and there was every indication before the meeting came to a close that practically all of the remaining one-third would file applications in the near future. Those responsible for calling and arranging for the meeting anticipated an attendance of about twenty-five. Before the closing session a total of forty-five persons had registered, practically all of whom were in attendance during the entire session. At a banquet held on the evening of the first day there was a total attendance of thirty-nine.

The meeting was called to order by R. W. Trullinger, chairman of the program committee. Prof. H. W. Riley, head of the rural engineering department at Cornell University, was elected temporary chairman. An address of welcome was made by Dean Betten, acting dean of the New York State College of Agriculture at Cornell. He was followed by an address by Dr. R. W. Thatcher, director of research, New York College of Agriculture, the subject of his address being "Fundamental Research in Agricultural Engineering and the Purnell Bill." Dr. Thatcher sounded the keynote of the entire meeting in his remarks on fundamental agricultural engineering research, which were entirely in accord with the views of A. S. A. E. Committee on Research and the efforts the committee has been making during recent years to organize and formulate a comprehensive program covering all phases of research in engineering as applied to agriculture.

A short address, entitled "Agricultural Engineering Degree Work at the Virginia Polytechnic Institute", was delivered by R. W. Trullinger, specialist in rural engineering of the U. S. Department of Agriculture. This was followed by a paper entitled "The Development of Apple Storages," by Prof. J. L. Strahan, of the Massachusetts Agricultural College.

The afternoon session of the first day was started off by a paper entitled "Relating Principles and Technique in Teaching," by Prof. T. H. Eaton, of the department of rural education at the New York State College of Agriculture. This was followed by an address entitled "The Proper Use of Physics and Chemistry in the Solution of Agricultural Engineering Problems," by Dean Wendt, of the Pennsylvania State College. Both papers stimulated a great deal of discussion which was participated in by practically every one in attendance.

The presentation of these two papers was followed by a business meeting, in which the North Atlantic Section of the American Society of Agricultural Engineers was formally organized and became a real entity. Following the decision of the meeting to organize the section the following officers were elected to serve for one year: Chairman, R. U. Blasingame, Pennsylvania State College; vice-chairman, C. I. Gunness, Massachusetts Agricultural College; secretary-treasurer, W. C. Harrington, field engineer, Syracuse branch of the Portland Cement Association. As provided by the constitution of the Section, the officers



The group of A. S. A. E. members and guests in attendance at the organization meeting of the North Atlantic Section of the Society held at Cornell University, Ithaca, New York, April 10 and 11

together with the retiring chairman constitute the executive committee of the Section.

A most enjoyable time by those present at the meeting was participated in at an informal banquet held at Forest Home Inn on the evening of the first day, at which Prof. H. W. Riley officiated as toastmaster. Anyone who knows Prof. Riley and has seen him perform as toastmaster will realize why it is possible to report the banquet as a most enjoyable and entertaining affair. The banquet was followed by informal round table discussions of various groups in the Dairy Building, which convened until late in the evening.

The second day session was opened by a very interesting and instructive address by Dr. C. H. Ladd, director of agricultural extension at Cornell, entitled "The Relation of Agricultural Engineering to Efficient Farm Management." Dr. Ladd's address stimulated a great deal of spirited and valuable discussion.

The remainder of the morning session was devoted to a paper, entitled "Extension Methods," by Prof. B. B. Robb, of the department of rural engineering at Cornell, and to a paper, entitled "Research in Dairy Barn Ventilation," by Prof. F. L. Fairbanks of the department of rural engineering at Cornell. Just at the close of the meeting it was decided that another meeting of the North Atlantic Section should be held some time during the fall. A desire expressed by those in attendance was that the next meeting should be held at Schnectady, New York, a cordial invitation having been extended by the General Electric Company to hold a meeting in that city as the guests of the company.

Election of A. S. A. E. Officers

THE election of officers of the American Society of Agricultural Engineers to hold office for one year following the annual meeting in June has been completed and the results of the election are as follows:

President: F. A. Wirt, advertising manager, J. I. Case Threshing Machine Company.

First Vice-President: John Swenehart, professor of agricultural engineering, University of Wisconsin.

Second Vice-President: M. A. R. Kelley, agricultural engineer, U. S. Department of Agriculture.

Member of Council: C. O. Reed, professor of agricultural engineering, Ohio State University.

Nominating Committee: Dan Scoates, O. B. Zimmerman, and William Boss.

Dr. Fortier Promoted to Consulting Position

DR. SAMUEL FORTIER, (Hon. Mem. A. S. A. E.) for the past eighteen years in charge of irrigation investigation for the U. S. Department of Agriculture west of the Missouri River, has, at his request, been transferred from his position as associate chief of the U. S. D. A. Division of Agricultural Engineering to a consulting basis.

Dr. Fortier has long been known as one of the outstanding authorities on irrigation in the country. Prior to becoming connected with the U. S. D. A. he was successively chief engineer of the Denver Union Water Works, chief engineer of the Bear River Canal Company of Utah, professor of civil engineering in the Utah Agricultural College, director of the Montana agricultural experiment station, and a consulting irrigation engineer of nation-wide reputation. From 1903 to 1907 he was in charge of irrigation investigations on the Pacific Coast and a member of the University of California faculty. He is still a member of the faculty of that institution as consulting professor of irrigation investigations and practice.

Dr. Fortier will be succeeded in his position of associate chief of the division of agricultural engineering of the U. S. D. A. Bureau of Public Roads by W. W. McLaughlin, who has been connected with the Department of Agriculture since 1903 and for a number of years was in charge of the irrigation work of the Department in Utah.

Student Branch Activities

University of Saskatchewan

THE students in agricultural engineering at the University of Saskatchewan "carried on" in their own little way for over a year by means of a local organzation which they had perfected, not knowing that their group was eligible for admission as a student branch of the American Society of Agricultural Engineers. Recently, however, their petition for a student branch was approved by the Council of the Society, and their organization has been completed and they have some real activities to their credit.

The members of this student branch give a great deal of credit to E. A. Hardy, professor of agricultural engineering at that institution, for the encouragement he gave in pointing out the benefits to the students of a student branch. He showed them that their outlook and grasp of agricultural engineering could be greatly enlarged by working together, and that by organizing they could do much to increase the value of their course and the organization could serve as a link between students, graduates, and faculty, to the benefit of all. The secretary of the branch writes: "We find ourselves accomplishing more things than we expected; besides increasing our knowledge of agricultural-engineering problems, we also have been learning how to speak and gather information. Some of the subjects that have been discussed at our meetings are fuels, oils, tractor dynamometers, and pulling contests, reclamation of wild lands, etc. * * * * * We are constantly on the lookout for prominent men in agricultural-engineering work who may come to the city with the idea of talking to the members of the branch on pertinent subjects. * * * * * The activities so far in our branch have greatly increased our interest in agricultural engineering, largely through the efforts of Prof. Greig and Prof. Hardy, and we are now looking forward to our organization becoming one of the strongest and most important in the university."

The officers for the branch for 1925 are honorary president, Prof. E. A. Hardy; president, W. C. Wood; secretary-treasurer, S. M. Henderson.

New A. S. A. E. Members

Arthur Richard Klaffky, Huntington, Long Island, New York.

Ludwig Holland-Letz, mechanical engineer, Letz Manufacturing Company, Crown Point, Indiana.

Walter Wesley McLaughlin, irrigation engineer, Box 180, Berkeley, California.

H. F. Reiss, vice-president, J. B. Colt Company, 30 E. 42nd Street, New York City.

Otto B. Stichter, manager, Louden Machinery Company, Albany, New York.

TRANSFER OF GRADE

Alfred Douglas Edgar, Committee on Relation of Electricity to Agriculture, 1017 Poyntz Avenue, Manhattan, Kansas. (From Student to Junior Member.)

Charles H. Everett, salesman, John Deere Plow Company, 1510 First Avenue North, Fort Dodge, Iowa. (From Student to Junior Member.)

J. Fletcher Goss, graduate fellow, agricultural engineering department, Iowa State College, Ames, Iowa. (From Student to Junior Member.)

F. W. Knipe, head of agricultural engineering department, Connecticut Agricultural College, Storrs, Connecticut. (From Junior Member to Member.)

Darrell B. Lucas, instructor in rural engineering, State University of New Jersey, New Brunswick, New Jersey. (From Junior Member to Associate Member.)

William Joseph Welker, farm engineering instructor, The Provincial School of Agriculture, Claresholm, Alberta, Canada. (From Student to Junior Member.)

Applicants for Membership

The following is a list of applicants for membership received since the publication of the April issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for the consideration of the Council prior to election.

George Waverly Cravens, vice-president, Climax Engineering Co., Clinton, Iowa.

Albert O. Kay, associate drainage engineer, division of agricultural engineering, U. S. Department of Agriculture, Cocoa, Florida.

Luther H. Koontz, drainage engineer, New Carlisle, Ohio.

Orla Glen Miller, lubrication engineer, Standard Oil Company, 910 S. Michigan Avenue, Chicago, Illinois.

Frederick Jewell Southerland, sales engineer, Pacific Gas and Electric Company, 245 Market Street, San Francisco, California.

Ray T. Wagner, commercial engineer and specialist in rural electrification, General Electric Company, Schenectady, New York.

TRANSFER OF GRADE

Ralph W. Baird, research fellow in agricultural engineering, Iowa State College, Ames, Iowa. (From Student to Junior Member.)

Erwin K. Young, drainage engineer, Zanesville, Ohio. (From Student to Junior Member.)

A. S. A. E. Employment Service

This service, conducted by the American Society of Agricultural Engineers, appears regularly in each issue of Agricultural Engineering. Members of the Society in good standing will be listed in the published notices of the "Men Available" section. Non-members as well as members, are privileged to use the "Positions Available" section. Copy for notices should be in the Secretary's hands by the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. No charge will be made for this service.

Men Available

AGRICULTURAL ENGINEER open for position as sales engineer, salesman, advertising writer, or agricultural propagandist. Past experience with large agricultural firms. MA-124.

AGRICULTURAL ENGINEER, 1925 graduate of Kansas State Agricultural College, with farm experience, would like permanent employment at once, preferably with a farm-machinery manufacturer. MA-125.

AGRICULTURAL ENGINEER, graduate of Iowa State College, E. E. 1909, A. E. 1910, desires to make change. Ten years experience in field and factory on tractors, trucks, and farm machinery. Five years teaching experience in agricultural engineering and farm mechanics. Instructional work along agricultural engineering lines preferred. MA-126.

Positions Open

ASSISTANT IN AGRICULTURAL ENGINEERING, with specific duties in irrigation and drainage, is wanted by the department of agricultural engineering of the University of Montana, Bozeman. The time is to be divided about half teaching and half experiment station work. The teaching will be at Bozeman and a large part of the station work will be done on the duty of water at a substation with supervisory duties at the substation. The position has responsibilities connected with it that will require mature judgment and some practical experience. The salary will be between $2000 and $2400. Candidates for this position should write Prof. H. E. Murdock, head of the department of agricultural engineering, at the University of Montana.

SALES ENGINEERS (two) wanted by Middle West manufacturing company. Applicant should have designing ability and a general knowledge of tractor and agricultural implement practice. The men we want are only those who can work their way into the confidence of customers through designing and engineering service. Actual sales experience in line with above qualifications is desirable. Write, giving name, age, and list of qualifications; also salary expected. PO-201.